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Illustrated.

The Coal Strike Situation

Greater progress has been made during the last week toward a settlement of the pending coal strikes than during any other week since the troubles began. Reports from the Southwest indicate that the miners and operators have come to terms on the basis of the Cincinnati compromise with an added proviso for arbitration in case of any future dispute. It is reported that the mines in the Southwest will be opened at once, leaving the details of the contract to later discussion.

As regards the Illinois strike, the situation has cleared materially, terms of agreement, largely based on the Peoria demands, having been tentatively reached. If the executive board of the operators should concur in the agreement, it is likely that work in the Illinois mines will be resumed this week. Although not entirely successful, the Illinois miners have won a good deal in forcing the compromise that has now been agreed upon. For this reason, John Walker, president of the Illinois unions, has greatly strengthened his position, and will undoubtedly be the strongest opponent of Mr. Lewis when the miners' convention occurs next year. Lewis and Walker have waged a bitter warfare, and as the two leaders differ widely in their policy and in their ideas, as well as in their methods of fighting, the future of the Miners' Union will depend largely upon which of the men is indorsed at the next national convention.

The general public has failed to appreciate the seriousness of the present coal strike in various fields. At no time in recent years have coal supplies been smaller than at present. In order to prevent a repetition of the coal famines that occurred in 1902-3, and again in 1906, the majority of our mines will have to work steadily this winter and even then certain parts of the West may lack fuel.

We have so often condemned these biennial coal strikes that it seems almost unnecessary to repeat the expression of our views. However, the evil results in certain sections from these recurrent troubles are so evident and so serious that they are hard to overlook. For several years each succeeding strike has weakened the operators in the Union field, and proportionately strengthened those in nonunion States.

In the present Illinois trouble, it may safely be said that politics has played the important part, and those persons responsible for the prolonged suspension will never know of the acute suffering experienced by many of the miners' families. It is not that the object sought through a strike is wrong, but that the method of obtaining it is crude and unworthy of the present age. Compulsory arbitration such as exists in Canada and other countries is probably the solution. This would force the few who fatten on the misery of many to seek more praiseworthy lines of pursuit.

The Bureau of Mines

The strained situation existing with respect to the organization of the recently created U. S. Bureau of Mines, regarding which we have commented several times, has been relieved by the appointment of Dr. Joseph A. Holmes to the directorship. With him as the permanent head, the plans for the development of

the new bureau can now be laid out in a systematic and comprehensive way and the ship can be steered through the dangers that will threaten it in gaining itsoffing by a captain who will realize that he is in charge for the voyage. There will be some strong currents to be breasted and there are some dangerous reefs to be passed, but we are confident that Doctor Holmes will safely navigate the channel and start upon a cruise that will be useful to our industry.

The appointment of Doctor Holmes was heralded by the daily press as a rebuff to Secretary Ballinger. We do not believe that it was intended to be anything of that sort, but was simply the recognition by the President that Doctor Holmes was the logical man for the position and was generally desired by the leaders of the mining industry. The President has made an appointment that will be widely approved.

Two Questions of Mine Management

We frequently encounter, especially in prospectuses and managerial confidences, statements exemplified by the following: In the A B C mine present developments show 5,000,000 tons of ore, of which 1,000,000 averages 3 per cent. copper, but although the remainder assays only 1.5 per cent., the whole averages 1.8 per cent., which will yield a profit of—. But no matter about the estimated profit. The object of our remarks is the fallacy of such reasoning. The grading down of rich ore does not generally increase profits. Thus in the example cited above, supposing a copper content of 1.8 per cent. just pays expenses, the averaging of all the ore would obviously be a poor policy, because the profit that could be obtained from one-fifth would be sacrificed. The four-fifths averaging only 1.5 per cent. could not be extracted except at a loss and should not be included with the valuable resources of the mine.

There are frequently modifying conditions. Thus some mines contain low-grade ore, unprofitable alone, which by admixture with the high-grade ore improves the ability to smelt the latter and therefore may be extracted profitably. Sometimes it may be advisable to charge the high-grade ore with all general, pumping and some other expenses and extract such low-grade ore as may be won profitably minus those charges, considering that when the high-grade ore is gone the low-grade never can be got. Often a good deal of low-grade ore must be broken down in order to get successfully to the high-grade and then, of course, such low-grade may be profitably milled.

But speaking generally, every part of a mine ought to stand on its own merits, and when the plan of grading down profitable ore with unprofitable is pursued we approach closely to the fallacy of mining barren rock in order to keep the mill running.

Another idea of prevalence is that in times of high prices it is best to mine the lower grades of ore, saving the higher grades for hard times. There may be something in this in so far as plans may be formulated to secure regularity of operations; but in mining as in other things, perhaps more so than in some, time is money, and the more value that can be quickly converted into bank deposits the richer will stockholders be. If all the ore of a mine be payable at minimum price for copper, a high price for the metal ought to stimulate extraction of the richest ore.

Discussion of these questions, upon which we have but lightly touched, would be useful in clarifying ideas. Each one has many phases and many qualifying conditions. Neither is absolutely simple.

Losses in Milling and Smelting

Milling and metallurgical practice is full of unsuspected losses. Many are the smelters who boast (and honestly believe) that they are extracting 95 per cent. of metal, who would change their mind if they could measure actually what escapes from their chimneys. Many are the millmen who opine that they collect all of the mineral that is possible and rub their eyes when some fellow sets up a buddle down the gulch and regains some of that which has been thrown away. Search for unsuspected losses is apt to be fruitful. It should begin with an accurate determination of the input into the works. Many a high percentage of extraction is due to an underweighing, or underassaying of the ore delivered for treatment.

Special Brands of Spelter

Special brands of spelter marketed with the brass manufacturers have lately been fetching a premium of 25@30c. per 100 lb. over the price of ordinary prime western, but now the smelters are finding difficulty in realizing so large a premium. Some of the smelters claim that even at that premium there has been no profit in the production of special grades of spelter under the recent conditions of the Joplin ore market. It is decidedly more difficult than formerly to obtain ore low in lead. Whereas, the smelters used to guarantee a lead content of their special spelter of less than 0.7 per cent., the guarantee is now 0.75 per cent., and it is not unlikely that the limit will be raised to 1 per cent.

Conservation has been the theme of discussion at St. Paul this week, and conservation as affecting the mining business has naturally come in for a large share of the talk. Elsewhere in this issue we publish excerpts from the address of the President. Upon several points made therein we shall comment, but this must be deferred until next week. However, we make haste to remark that his recommendation that the law of the apex be allowed to stand, just because it has stood for many years, will not appeal favorably to the more enlightened thought.

We are glad that George E. Roberts is to return to the directorship of the mint. In his former tenure of that position he was distinctly successful and he now goes back to it with the additional prestige of success in filling the presidency of an important national bank. The mint is the market place for a large part of the product of the mining industry, its refineries are important metallurgical establishments, and its statistical records are of value to commerce and finance. The President is to be congratulated upon his persuasion of Mr. Roberts to accept the directorship once more.

A semi-official announcement of importance to silver-lead mining interests of British Columbia was made by Minister of Mines William Templeman when he stated, while at Nelson, B. C., recently, that the department had decided to grant a further subsidy for lead production.

President Taft on Conservation of Mineral Lands

The Law of the Apex Should Stand; Recommends Leasing Mineral Rights Only in Government Coal, Oil and Phosphate Lands

WATER POWER CONTROL TO BE DECIDED

In his speech before the National Conservation Congress at St. Paul on Sept. 5, President Taft stated that the time had come to call a halt in the emotional rhapsodies that had been brought forth about conservation, and he deprecated the agitation in favor of the Federal Government contributing toward enterprises that should be undertaken by private capital, or by the States. The whole conservation movement if promoted on these lines would die for want of practical direction. It is recognized that there has been waste and that what is left must be administered with care and prudence. The practical question is how this shall be done under existing law and necessary amendment. While the President has left open the question of whether water-power sites should be controlled by the Federal or State governments, he has stated clearly his ideas on conservation as applied to mineral lands. His remarks on this phase of the subject are quoted below:

No Change in Metalliferous Mineral Land Laws

"By mineral lands I mean those lands bearing metals, or what are called metalliferous minerals. The rules of ownership and disposition of these lands were first fixed by custom in the West, and then were embodied in the law, and they have worked, on the whole, so fairly and well that I do not think it is wise now to attempt to change or better them.

"The apex theory of tracing title to a lode has led to much litigation and dispute and ought not to have become the law, but it is so fixed and understood now that the benefit to be gained by a change is altogether outweighed by the inconvenience that would attend the introduction of a new system.

"So, too, the proposal for the Government to lease such mineral lands and deposits and to impose royalties might have been in the beginning a good thing, but now that most of the mineral land has been otherwise disposed of it would be hardly worth while to assume the embarrassment of a radical change.

Coal Lands Should be Leased

"The next subject, and one most important for our consideration, is the disposition of the coal lands in the United States and in Alaska. First, as to those in the United States. At the beginning of this administration there were classified coal lands amounting to 5,476,000 acres and there were withheld from entry for purposes of classification 17,867,000 acres. Since that time there have been withdrawn by my order from entry for classification 77,648,000 acres, making a total withdrawal of 95,515,000 acres. Meantime, of the acres thus withdrawn 11,371,000 have been classified and found not to contain coal and have been restored to agricultural entry, and 4,356,000 acres have been classified as coal lands, while 79,788,000 acres remain withdrawn from entry and await classification. In addition 336,000 acres have been classified as coal lands without prior withdrawal, thus increasing the classified coal lands to 10,168,000 acres.

"I have looked with some care into a report made at the instance of President Roosevelt upon the disposition of coal lands in Australia, Tasmania and New Zealand. These are peculiarly mining countries, and their experience ought to be most valuable. In all these countries the method for the disposition and opening of coal mines originally owned by the Government is by granting leasehold. and not by granting an absolute title. The terms of the leases run all the way from 20 to 50 years, while the amount of land which may be leased to any individual there is from 320 acres to 2000 acres. It appears that a full examination was made and the opinions of all the leading experts on the subject were solicited and given, and that with one accord they approved in all respects the leasing system. Its success is abundantly shown. It is possible that at first considerable latitude will have to be given to the executive in drafting these forms of lease, but as soon as experiment shall show which is the most workable and practicable, its use should be provided for specifically by statute.

Alaska Coal Lands

"The investigations of the Geological Survey show that the coal properties in Alaska cover about 1200 square miles, and that there are known to be available about 15,000,000,000 tons. This is, however, an underestimate of the coal in Alaska, because further developments will probably increase this amount many times; but we can say with considerable certainty that there are two fields on the Pacific slope which can be reached by railways at a reasonable cost from deep water—in one case of about 50 miles and in the other case of about 150 miles—which will afford certainly 6,000,000,000 tons of coal, more than half of which is of a very high-grade of bituminous and of anthracite. It is estimated to be worth, in the ground, one-half a cent a ton, which makes its value per acre from $50 to $500. The coking coal lands of Pennsylvania are worth from $800 to $2000 an acre, while other Appalachian fields are worth from $10 to $386 an acre, and the fields in the Central States from $10 to $2000 an acre, and in the Rocky Mountains $10 to $500 an acre. The demand for coal on the Pacific coast is for about 4,500,000 tons a year.

"With a regular coal supply established, the expert of the Geological Survey, Mr. Brooks, who has made a report on the subject, does not think there would be an excessive profit in the Alaska coal mining, because the price at which the coal could be sold would be considerably lowered by competition from these fields and by the presence of crude fuel oil. The history of the laws affecting the disposition of Alaska coal lands shows them to need amendment badly. Speaking of them, Mr. Brooks says:

History of Alaskan Laws

" 'The first act, passed on June 6, 1900, simply extended to Alaska the provisions of the coal land laws in the United States. The law was ineffective, for it provided that only subdivided lands could be taken up, and there were then no land surveys in Alaska. The matter was rectified by the act of April 28, 1904, which permitted unsurveyed lands to be entered and the surveys to be made at the expense of the entrymen. Unfortunately, the law provided that only tracts of 160 acres could be taken up and no recognition was given to the fact that it was impracticable to develop an isolated coalfield requiring the expenditure of a large amount of money by such small units. Many claims were staked, however, and surveys were made for patents. It was recognized by everybody familiar with the conditions that after patent was obtained these claims would be combined in tracts large enough to assure successful mining operations. No one experienced in mining would, of course, consider it feasible to open a coal field on the basis of single 160-acre tracts. The claims for the most part were handled in groups, for which one agent represented the several different owners.

Combination of Claim Owners

" 'Unfortunately, a strict interpretation of the statute raised the question whether even a tacit understanding between claim

owners to combine after patents had been obtained was not illegal. Remedial legislation was sought and enacted in the statute of May 28, 1908. This law permitted the consolidation of claims staked previous to Nov. 12, 1906, in tracts of 2560 acres. One clause of this law invalidated the title if any individual or corporation at any time in the future owned any interest whatsoever, directly or indirectly, in more than one tract. The purpose of this clause was to prevent the monopolization of coalfields; its immediate effect was to discourage capital. It was felt by many that this clause might lead to forfeiture of title through the accidents of inheritance, or might even be used by the unscrupulous in blackmailing. It would appear that land taken up under this law might at any time be forfeited to the Government through the action of any individual who, innocently or otherwise, obtained interest in more than one coal company. Such a title was felt to be too insecure to warrant the large investments needed for mining developments. The net result of all this is that no titles to coal lands have been passed.

Withdrawal of Alaska Coal Lands

"On Nov. 12, 1906, President Roosevelt issued an executive order withdrawing all coal lands from location and entry in Alaska. On May 16, 1907, he modified the order so as to permit valid locations made prior to the withdrawal on Nov. 12, 1906, to proceed to entry and patent. Prior to that date some 900 claims had been filed, most of them said to be illegal because either made fraudulently by dummy entrymen in the interest of one individual or corporation, or because of agreements made prior to location between the applicants to coöperate in developing the lands. There are 33 claims for 160 acres each, known as the 'Cunningham claims,' which are claimed to be valid on the ground that they were made by an attorney for 33 different and *bona fide* claimants who, as alleged, paid their money and took the proper steps to locate their entries and protect them. The representatives of the Government in the hearings before the Land Office have attacked the validity of these Cunningham claims on the ground that prior to their location there was an understanding between the claimants to pool their claims after they had been perfected and unite them in one company. The trend of decision seems to show that such an agreement would invalidate the claims, although under the subsequent law of May 28, 1908, the consolidation of such claims was permitted, after location and entry, in tracts of 2560 acres.

No Coal Titles Yet Perfected

"It would be, of course, improper for me to intimate what the result of the issue as to the Cunningham and other Alaska claims is likely to be, but it ought to be distinctly understood that no private claims for Alaska coal lands have as yet been allowed or perfected, and also that whatever the result as to pending claims, the existing coal-land laws of Alaska are most unsatisfactory and should be radically amended. To begin with, the purchase price of the land is a flat rate of $10 per acre, although, as we have seen, the estimate of the agent of the Geological Survey would carry up the maximum of value to $500 an acre.

Develop Alaska Coal Lands

In my judgment is is essential in the proper development of Alaska that these coal lands should be opened, and that the Pacific slope should be given the benefit of the comparatively cheap coal of fine quality which can be furnished at a reasonable price from these fields; but the public, through the Government, ought certainly to retain a wise control and interest in these coal deposits, and I think it may do so safely if Congress will authorize the granting of leases, as already suggested, for Government coal lands in the United States, with provisions forbidding the transfer of the leases except with the consent of the Government, thus preventing their acquisition by a combination or monopoly and upon limitations as to the area to be included in any one lease to one individual, and at a certain moderate rental, with royalties upon the coal mined proportioned to the market value of the coal either at Seattle or at San Francisco. Of course, such leases should contain conditions requiring the erection of proper plants, the proper development by modern mining methods of the properties leased and the use of every known and practical means and device for saving the lives of the miners.

"The Government of the United States has much to answer for in not having given proper attention to the government of Alaska and the development of her resources for the benefit of all the people of the country. I would not force development at the expense of a present or future waste of resources; but the problem as to the disposition of the coal lands for present and future use can be wisely and safely settled in one session if Congress gives it careful attention.

Oil and Gas Lands

"In the last administration there were withdrawn from agricultural entry 2,820,000 acres of supposed oil lands in California; about 1,500,000 acres in Louisiana, of which 6500 acres were known to be vacant unappropriated land; 75,000 acres in Oregon and 174,000 acres in Wyoming, making a total of nearly 4,000,000 acres. In September, 1909, I directed that all public oil lands, whether then withdrawn or not, should be withheld from disposition pending congressional action, for the reason that the existing placer mining law, although made applicable to deposits of this character, is not suitable to such lands, and for the further reason that it seemed desirable to reserve certain fuel-oil deposits for the use of the American navy. Accordingly the form of all existing withdrawals was changed, and new withdrawals aggregating 2,750,000 acres were made in Arizona, California, Colorado, New Mexico, Utah and Wyoming. Field examinations during the year showed that the original withdrawals, 2,170,000 acres were not valuable for oil, and they were restored for agricultural entry. Meantime, other withdrawals of public oil lands in these States were made, so that July 1, 1910, the outstanding withdrawals then amounted to 4,550,000 acres.

Leasing of Oil Lands Recommended

"The needed oil and gas law is essentially a leasing law. In their natural occurrence oil and gas cannot be measured in terms of acres, like coal, and it follows that exclusive title to these products can normally be secured only after they reach the surface. Oil should be disposed of as a commodity in terms of barrels of transportable product rather than in acres of real estate. This is, of course, the reason for the practically universal adoption of the leasing system wherever oil land is in private ownership.

Withdrawal of Phosphate Lands

"Phosphorus is one of the three essentials to plant growth, the other elements being nitrogen and potash. Of these three, phosphorus is by all odds the scarcest element in nature. It is easily extracted in useful form from the phosphate rock, and the United States contains the greatest known deposits of this rock in the world. They are found in Wyoming, Utah and Florida, as well as in South Carolina, Georgia and Tennessee. The Government phosphate lands are confined to Wyoming, Utah and Florida. Prior to March 4, 1909, there were 4,000,000 acres withdrawn from agricultural entry on the ground that the land covered phosphate rock. Since that time 2,322,000 acres of the land thus withdrawn was found not to contain phosphate in profitable quantities, while 1,678,000 acres was classified properly as phosphate lands.

"During this administration there has been withdrawn and classified 437,000 acres, so that today there is classified as phosphate-rock land 2,115,000 acres. This rock is most important in the composition of fertilizers to improve the soil, and as the future is certain to create an enormous demand throughout this country for fertilization, the value to the public of such deposits as these can hardly be exaggerated. Certainly with respect to these deposits a careful policy of conservation should be followed.

Leasing Phosphate Land with Separate Surface and Mineral Rights

"A law that would provide a leasing system for the phosphate deposits, together with a provision for the separation of the surface and mineral rights, as is already provided for in the case of coal, would seem to meet the need of promoting the development of these deposits and their utilization in the agricultural lands of the West. If it is thought desirable to discourage the exportation of phosphate rock and the saving of it for our own lands, this purpose could be accomplished by conditions in the lease granted by the Government to its lessees. Of course, under the Constitution, the Government could not tax and could not prohibit the exportation of phosphate, but as proprietor and owner of the lands in which the phosphate is deposited, it could impose conditions upon the kind of sales, whether foreign or domestic, which the lessees might make of the phosphate mined."

The Lake Superior Mining Institute

The fifteenth annual meeting of the Lake Superior Mining Institute began at Ironwood, Mich., Aug. 24. The headquarters were at the Ironwood Club rooms. The day was spent in visiting points of interest on the Gogebic range, special trains being provided for the transportation of the party. The mines visited in Ironwood included the Ashland, East Norrie, Pabst and Newport, operated respectively by the Cleveland-Cliffs Iron Company, the Oliver Iron Mining Company and the Newport Mining Company.

Equipment of Newport Shaft

Particular interest was taken in the equipment of shaft D of the Newport mine, which is a foot-wall shaft, 2360 ft. deep. This shaft is probably one of the largest producers of any single underground operation of its depth in the Lake Superior region.

After the business meeting in the evening at Ironwood, the party boarded a special train of sleeping cars and arrived in Chicago at 11 a.m., Thursday. A visit was first paid to the plant of the Sullivan Machinery Company, manufacturer of mining and quarrying machinery. Following this, the members enjoyed an automobile ride through the park and boulevard districts of Chicago's west side. A stop was made at the warehouses of Joseph T. Ryerson & Son, where a lunch was served and an opportunity given to inspect the Ryerson warehouses.

Election of Officers

Late in the afternoon the members took the special train to Gary, Ind., where a business session was held in the evening. The event of chief interest was the election of officers for the ensuing year. W. J. Richards, Crystal Falls, Mich., general superintendent of the Corrigan, McKinney & Co. mines on the Menominee range, was chosen president of the institute; two vice-presidents were elected, E. D. Brigham, Chicago, and C. H. Munger, Duluth; three managers were also chosen, Peter W. Pasco, Republic, Mich., J. B. Cooper, Hubbell, Mich., and L. C. Brewer, Ironwood, Mich. Secretary A. J. Yungbluth, and Treasurer C. W. Hopkins, were reëlected.

Inspection of Gary Plant

Friday morning, Aug. 26, the members of the institute were the guests of the Indiana Steel Company, at its plant at Gary. A special train was provided, which visited all parts of the new plant. Particular attention was paid to the ore-handling devices and the rail mill. Leaving Gary at 1 p.m., the train returned to Chicago, where the convention closed with a dinner at the Auditorium hotel. Judge Norman W. Hare, of Houghton, Mich., presided at the banquet. From Chicago the members returned to Ironwood by the special train.

Three interesting and important papers were presented at this session: "A Diamond-drill Core Section of the Mesabi Rock," by N. H. Winchell; "The Proper Detonation of High Explosives," by Charles S. Hunter; "Underground Steel Construction—Particularly Mine shafts." by R. B. Woodworth.

The Bureau of Mines

Washington Correspondence

Announcement was made here on the morning of Sept. 1, that President Taft had named Dr. J. A. Holmes, formerly chief of the Technologic Branch of the Geological Survey, as chief of the Bureau of Mines. The announcement came as a surprise, Mr. Holmes himself having had no information concerning the prospective appointment until the midnight previously. In no way had there been any consultation between the executive offices at Beverly, Mass., and the appointee. Friends of Dr. Holmes had practically given up all expectation of the President's determining upon such action and they were well assured that the action, if taken at all, would not be taken until the arrival of Director George Otis Smtih, of the Geological Survey, who is not expected to return to this country from Europe until the middle of October.

Various interpretations were promptly placed upon the action of the President, one being that the step was political in character and designed to show entire independence of Secretary Ballinger, or perhaps a disposition to refuse to be guided by the latter's supposed wishes. The second interpretation was simply that the President, having given other candidates opportunity to make good their claims to the appointment, and not feeling that the rivals of Mr. Holmes had succeeded in making out a case, had resolved to recognize the superior indorsements that have been accorded to Holmes. The fact is that there is no positive evidence of the direct antagonism of Secretary Ballinger.

Bureau Policies to Continue as Originally Outlined

Dr. Holmes, when consulted about the present situation in the bureau, stated generally that he had nothing to say for publication, especially as the appointment will not go into effect immediately. He said, however, that the work of the Bureau of Mines would proceed precisely as at present and with no substantial alteration of policy. Dr. Smith, who has been in charge since the adjournment of Congress, has practically put into operation the plans which had been made by Dr. Holmes and which had been recommended at an earlier date, so that there is nothing to be done except to continue to follow them out. A few minor changes may occur, but nothing of sweeping character. Among other innovations will, however, probably be the moving of the Bureau of Mines into another building apart from the Geological Survey. The chief point about which interest is now centering is that of the relations to exist between the Bureau of Mines and the Survey, Director Smith in a recent authorized statement having plainly indicated that coöperation between the two bureaus on the present basis would be difficult if not impossible.

Low Price for California Oil

The price of oil in California has been declining ever since the big gushers have so greatly augmented production. Before the extraordinary heavy output began to affect the market 63c. per bbl. had been given for fuel oil.

The Associated Oil Company until quite recently, has been paying 50c. per bbl. The *San Francisco Chronicle*, Sept. 1, 1910, states that the price has been hovering around 40c. for a week or so and that now the Associated will only contract for oil at 30c. per bbl. It is, however, paying more for a large portion of its oil as its contracts call for a higher figure.

Returns from El Oro mine, near El Oro, Mexico, for the year ended June 30, 1910, show that the gold bullion realized was 94.18, and silver 78.56 per cent., of the value of the ore treated as shown by assays.

DETAILS of PRACTICAL MINING

Notes of Interest to Prospectors and Operators of Small as Well as Large Mines. Things That Have to Be Done in Everyday Mining

Arrangement for Guiding a Drop Shaft

The sinking of the W. F. 2 shaft at Obernkirchen, South Hanover, Germany, encountered just below the surface an 18-m. zone of watery sand and clay, necessitating the use of drop-shaft methods. The manner in which the shaft was guided in the true vertical direction is of interest, and is illustrated in the accompanying sketch.

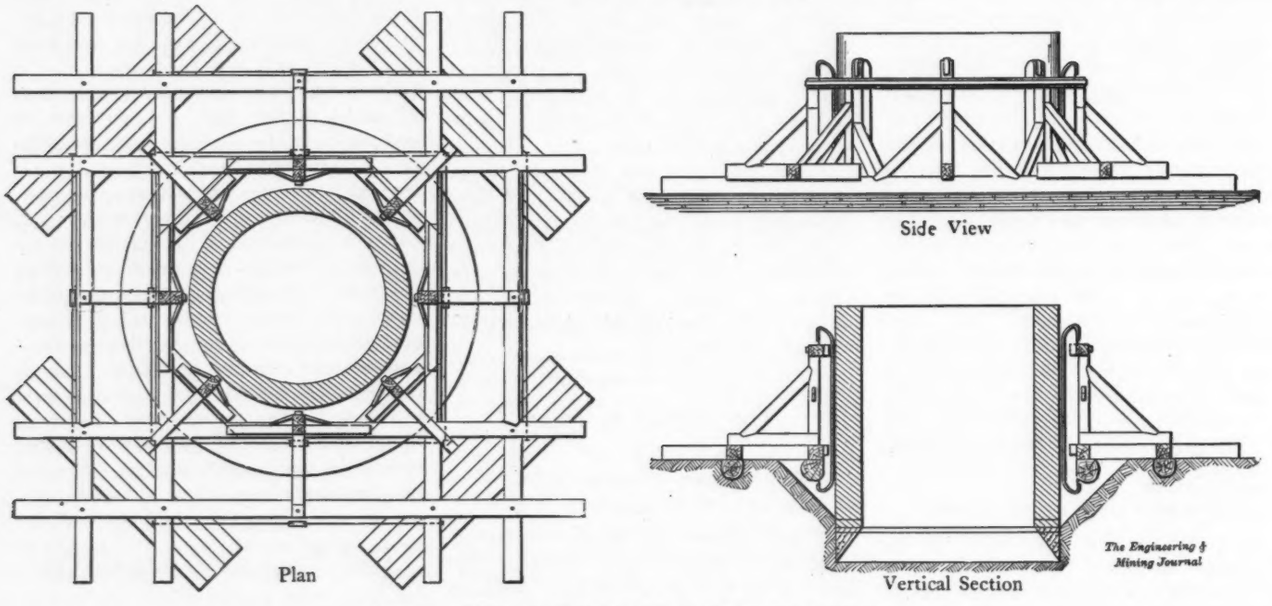
The inside diameter of the finished shaft was required to be 4.5 m.; the concrete wall of the drop shaft was therefore molded to an inside diameter of 5.5 m., with walls 77 cm. thick. The outside of the wall was coated with cement plaster and then smeared thickly with brown soap, whereby the friction of the shaft against the guides was greatly reduced. It was only necessary to build the walls 16 cm. above the top of the guides to maintain the weight required to give a steady downward motion. The sinking went on without incident to a depth of 14.5 m., when the wall refused to drop further, even though it was heavily weighted and the top built up to a hight of 3.16 m. above the guides.

An Interior Drop Shaft Had to Be Used

It was ascertained by boring that a further depth of only 7 m. was necessary to reach solid strata, and it seemed possible to gain this distance by forepoling. Before this plan could be put into operation, however, an inrush of material under the sinking shoe made it imperative to adopt a second, interior drop shaft, made of sheet iron. The bottom of the concrete shaft was firmly puddled with clay, and the iron drop shaft, of 4.95 m. inside diameter and 15.8 m. high, was lowered into place.

Sinking by this means went on rapidly until solid strata were encountered at a depth of 21.76 meters. The shaft was continued into the rock to a further depth of 6 m., leaving 3 m. of the iron wall reaching up inside the concrete wall of the outer shaft. The space between these two walls was then filled with cement grouting (equal parts of quick-setting cement and sand) by boring holes through the iron plates and connecting the holes with pipes reaching to the surface. The upper 20 cm. of the space was filled with pitch-pine *picotage*.

The first 5 m. in the solid rock were lined with cast-iron tubbings and a masonry bearing ring, behind which all the spaces were thoroughly grouted. At a depth of 32.6 m. sinking was begun in the ordinary manner, with masonry lining.



ARRANGEMENT OF GUIDES FOR DROP-SHAFT SINKING

The expenditures of the aid fund of the Calumet & Hecla Mining Company amounted to $78,934.48 during the last fiscal year.

The Necessity for Strong Detonators

In detonating high explosives, the stronger or sharper the initial shock the quicker and more thorough is the detonation of the charge. If the detonation is slow and incomplete a greater quantity of explosive is required to do the same work, and large volumes of poisonous gases are evolved—a matter of serious consequence in underground work. Quick and complete detonation results in a minimum of flame, a point of first importance with those explosives intended for use in the presence of inflammable gas or coal dust. Electric fuses or blasting caps too weak to detonate a charge of high explosives frequently generate sufficient heat to ignite it.

The effect of a detonator on a charge of high explosives in a bore hole is by no means infinite, but decreases with distance. It is, therefore, easy to understand the necessity for using detonators sufficiently strong for the effect of the detonator to extend as far as possible through the charge. It should not, however be understood that the detonator should be located in the center of the charge, for numerous tests have shown that the greatest effect of a detonator is straight away from its loaded end, and in a line with its long axis, i.e., a detonator will explode a cartridge of dynamite farther away from it, if it is lying with

the loaded end pointed toward the cartridge, than it will if it is lying parallel to the cartridge. It may be impossible to explain this, but it is known to be a fact.

Blasting Long Charges Requires Additional Caps

In deep bore holes loaded with long charges, it is well to place caps in cartridges of explosives at intervals of at least five feet throughout the charge, so that the effect of the explosive material which they contain will extend the entire length of the charge. Two electric fuses should be used in deep bore holes so that if one be defective the other can be depended upon for the initial detonation.

Margin of Safety in Strength Advisable

The charge contained in detonators is readily affected by moisture, and consequently, unless storage conditions are of the best, a fair margin of safety in strength should be allowed when selecting the grade to be used. Blasting caps, being open at one end, are more quickly weakened by dampness than are electric fuses.

Considering the very small cost of the detonator in comparison with that of the charge of explosives with which it is used, it is difficult to understand why anyone, in order to save a few cents on the price of a hundred caps, would risk the misfire, partial detonation or imperfect work of the charge of explosives in a bore hole which results at best in the loss of several dollars and may cost thousands if the charge burns in a gaseous coal mine; or unexploded dynamite subsequently causes a fatal accident.

Strong Detonators Recommended by Geological Survey

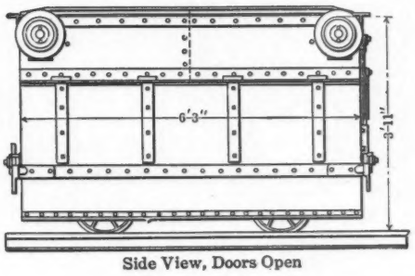
The extended study and tests of explosives, conducted by the Technologic Branch of the U. S. Geological Survey, demonstrated the economy of using only strong detonators. As a result of tests it is stated[1] that electric or other detonators containing not less than 1 gram of fulminating composition (90 parts by weight of mercury fulminate and 10 parts of potassuim chlorate, or its equivalent) should be used in firing charges of "permissible" explosives and with high explosives in rock blasting. Further, that an electric or other detonator of less strength than No. 5, containing 0.8 gram of the fulminating composition, should under no circumstances be used as the greater efficiency and certainty of the stronger detonator more than make up for the slightly greater cost.

Summarizing, strong electric fuses and blasting caps should be used with all high explosives because: They reduce the chances of misfire as their effect carries farther in the charge; they increase the execution of the explosive; they tend to counterbalance careless and improper usage; they offset to some extent, deterioration due to improper storage; they reduce to a minimum fumes from the explosive; they decrease the size and duration of flame, and prevent the loss of the charge by burning. The above information is largely taken from the advance sheets of a catalog to be published by the E. I. du Pont de Nemours Powder Company.

[1]*Bull.* 423, A Primer on Explosives for Coal Miners, U. S. Geol. Surv., p. 52.

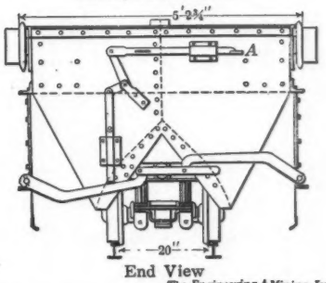
Furnace Charging at the Granby Smeltery

At the Granby smeltery, Grand Forks, B. C., coke and ore are charged separately into the furnaces. A train of three charge cars, similar to the design shown in the cut, is taken by a 30-horsepower electric locomotive under the bins and



Side View, Doors Open

Locks, Doors Closed



End View

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Furnace-charging Car at Granby Smeltery

receives 1¼ tons of coke. This is weighed and charged into the furnace, and the train immediately returns to the bin for the ore charge. Ten tons of ore are run into the cars, weighed and emptied into the furnace. This separate charging of coke and ore, says Frank E. Lathe (June *Bull.*, Can. Min. Inst.), insures as even distribution of both, and a consequent high fuel efficiency in smelting operations.

The cars are supplied with two sets of wheels, as shown in the cut, the lower for ordinary locomotion, and the upper, near the top, for supporting the cars on the heavy rails set in the side walls of the furnace when the cars enter with their load. When the cars are completely inside the furnace, the feeder, by means of a long iron hook, pulls the arm marked *A* in the drawing. This releases the lock, and the contents of the cars fall upon the charge below. Usually the locks of two cars are chained together, so that they dump at the same time.

In practice, the time occupied from the moment the first car enters the furnace until it is again withdrawn, is from 10 to 20 sec. When the cars are removed, the hoppers are again closed, and the second trip commences. Complete charges of both coke and ore are made every 20 to 30 min. to each furnace, and one motor supplies all the furnaces. This indicates the speed of operation required.

As the cars are divided into four compartments, and the motion given the contents is toward the sides of the furnaces, there is no very definite separation of coarse and fine ore. There is a slight tendency, however, for the coarser ore to fall near the center and at the very outside, the fines occupying the two intermediate positions. This is productive of a very uniform descent of charge all over the furnace. Of course, it is easy, in the case of uneven conditions prevailing in the different parts of the furnace, to omit the ore charge from one or more compartments in any car; or to add extra coke as may be necessary.

Classifier for Use Before Concentrators

By E. W. Durfee *

The desirability of close-screen sizing of mill products before concentration cannot be questioned by those familiar with the work. Could it be carried successfully to the fine sizes without too much expense, little would be desired in the classification of ores for concentration purposes. It is my opinion, however, that for sizes smaller than about 30 mesh the products from water classification will give equally good, if not better results for table concentration.

Water Classification Advantageous

If one will observe closely the operation of a Wilfley table, handling the product from poor screen sizing (which is the rule in fine screening) he will notice that the finest particles of the heaviest mineral occupy the position closest to the table top and fill the interstices between the larger heavy particles. Next above are the lighter minerals similarly arranged and finally the top stratum is made up of coarse and fine quartz particles. In the operation of the table there is little trouble in washing off the coarse quartz particles, but there is always a

*Manager, Alvarado Gold Mining Company, Congress Junction, Ariz.

certain amount of fine quartz lodged among the coarser, heavier minerals, which it is impossible to separate on the table.

With these conditions in mind it is plain to see that water classification is the ideal system for making products for table concentration. The finer heavy minerals will go with the coarser lighter ones in which case the bedding on the table top will be, the finer heavier minerals, above which will come coarser, lighter ones that can be easily washed off, there being no spaces among the heavy mineral particles large enough to inclose and hold them back.

Ideal Pulp for Table Concentration

In making tests for the separation of pyrite and sphalerite in the complex lead, zinc, iron ores treated at the Daly-Judge mill in Park City, Utah, while general superintendent for that company, a novel classifier was tried and afterward installed on account of the excellent work performed.

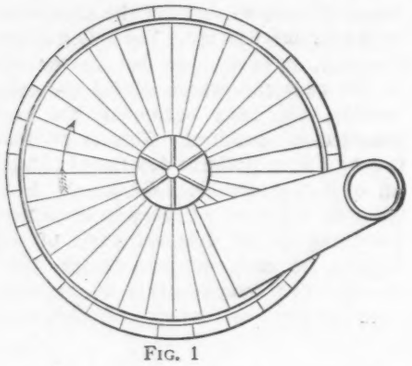


Fig. 1

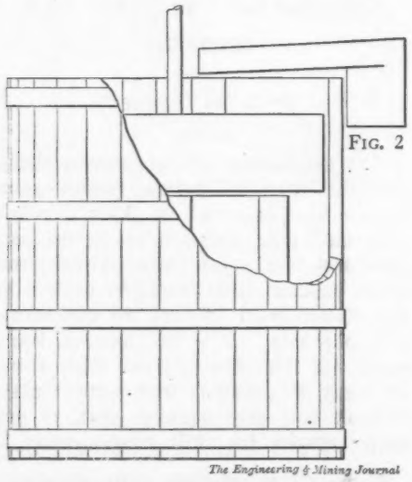


Fig. 2

The Engineering & Mining Journal

Daly-Judge Classifier for Fine Material

The principle of the machine is based upon the free setting of minerals in water and the separation of the various products by revolving the columns of water, in which the minerals settle, around the central axis in a tank, thus distributing the classified products into different compartments. The products from these compartments are delivered through spigots to the concentrating machines.

The machine consists of a tank about 5 ft. in hight by 4 ft. in diameter, the lower 3½ ft. of which is made so that it can be divided radially by sliding partitions. The number of these partitions depends upon the number of sizes required while their position can be determined by experimenting with the product to be treated.

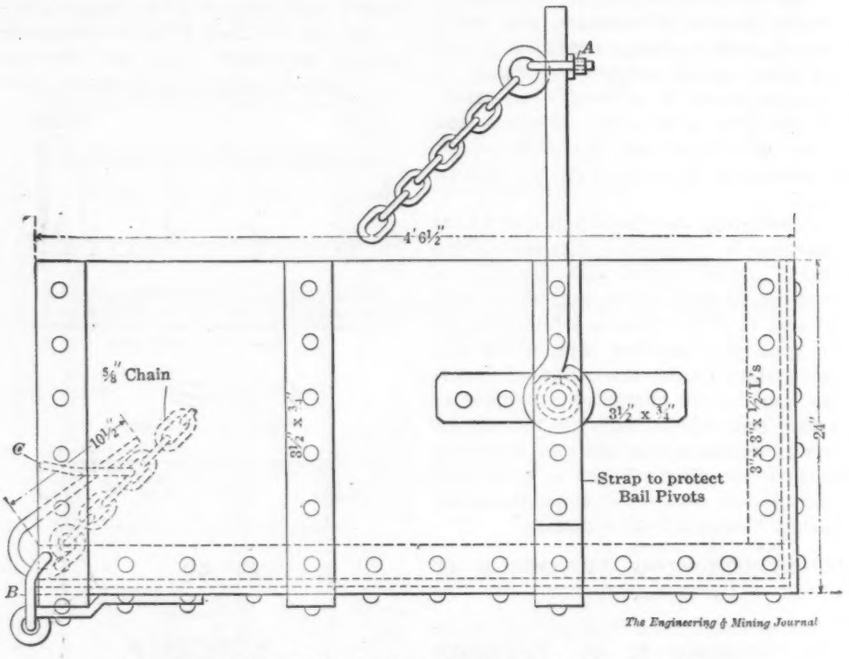
Operation of the Classifier

The part that comprises the settling columns for the minerals revolves in a vertical position just above the partitions which separate the various sizes. It is made about one foot long, of sheet iron, cylindrical in form and as large as will revolve in the tank, and has a central cylindrical core about one foot in diameter, the periphery being divided into 32 equal compartments which are open at both ends. This revolves just below the surface of the water in the tank, making about one revolution per minute. The feed is delivered from a stationary position at one side. As a compartment of the revolving unit passes underneath the feed, a portion is caught and settles as it revolves around the central axis. The coarsest and heaviest particles passing through most quickly drop into the first compartment, the finer into the next, and so on around. The time of revolution can be adjusted so that the finest mineral will have settled through the revolving unit by the time the compartment has returned to the position underneath the feed. Fig. 1 shows a plan view and Fig. 2 a side elevation and partial section of the assembled machine.

The Mineville Ore Bucket

Buckets used in Mineville, N. Y., for hoisting from an open pit or a large winze present certain advantages over the usual cylindrical type in the manner of loading and dumping. They are of the stone-boat type. The bucket can be drawn to the foot of the stope of ore, where the low sides and large filling area facilitate the loading by hand shovels.

Preparatory to hoisting, the chain which is attached by U-bolt *A* to the bail is made fast to the lip of the bucket by passing the hook on the free end of the chain through a 3-in. ring *B* welded in the eye of a strap of flat iron which is riveted to the bottom of the bucket. The hook is bent at such an angle that after passing through the eye it can be forced back against the chain and locked in this position by a slip-ring *C*. The bucket after being locked is hoisted vertically to the top of the pit and then carried out horizontally on the traveling cable to the loading tracks, or in the case of a winze near the top of the headframe the bail is hooked by an auxiliary rope and as the bucket is lowered it is carried out to the dumping chute. By knocking the slip-ring with a shovel, the hook is released and the bucket discharges its contents.



Iron-ore Bucket Used by Port Henry Iron Ore Company

The bucket is 24 in. deep, 4 ft. 6½ in. long and weighs 1100 lb. The body is made of ½-in. steel plate, with the corners reinforced by 3x3x½-in. angle.

The Homestake creosoting plant at Lead, S. D., is not used for mine timbers, but mainly for ties and battery-block lumber.

Placing Sills beneath Square Sets Already in Place

The correct practice in square-set timbering is to place the sills upon the floor of the stopes before the sets are put in. Yet, through false ideas of economy, the placing of sills is frequently neglected with the result, when it becomes desirable to stope the ore up to the floor of one level from that next below, the operation can only be accomplished by catching up the square-set posts from below at the expense of much time and labor.

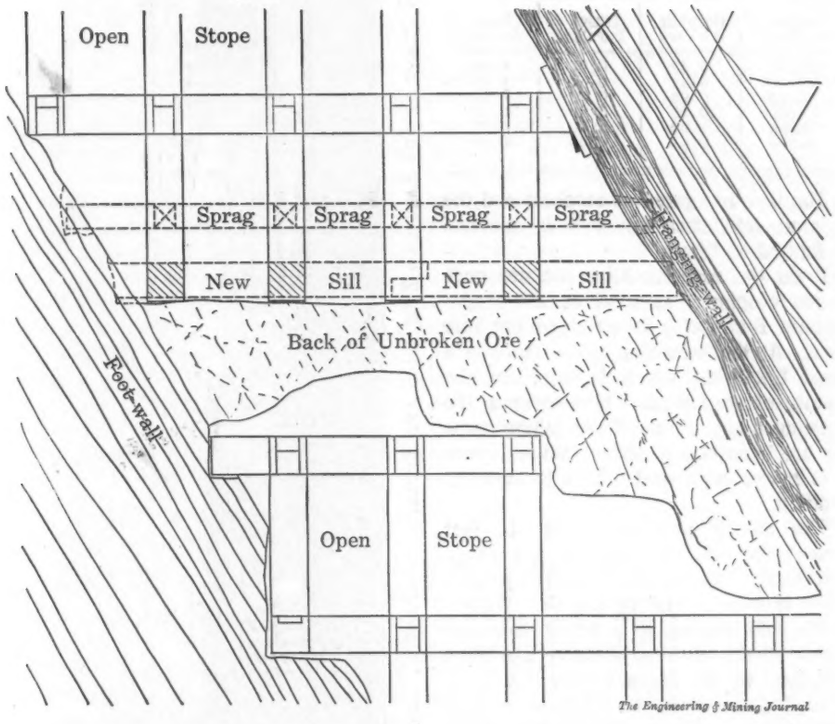
Placing of Sills Neglected on Mother Lode

On the Mother Lode, of California, there are few mines where sills are placed on the floors of the levels, it being claimed that the sills will rot before a stope is worked through from one level to that next above. Owing to the large sectional area of most stopes in these mines and to the heavy swelling ground commonly encountered, this statement, generally speaking, is without doubt true. These conditions might be met by cutting stopes of smaller sectional area, i.e., if the stopes were worked in sections extending from foot- to hanging-wall but only for 30 or 40 ft. along the vein.

Generally, however, the stope is opened on the level of the gangway to the full width of the vein and for the entire length of the ore shoot, before any considerable upward stoping is undertaken. This practice in most cases eventually results in giving the mine management more or less trouble later on, which is rendered worse by failure to provide sills on the floor of the level, and by the failure to fill the stope completely as work progresses upward. Close filling of the stope is often neglected as all of the waste rock, in most cases, has to be broken from the walls, and this entails considerable extra expense.

Sets Should Line Vertically

In many cases sills may be inserted beneath the posts of the sets long after they have been in place, and the ore from the back of the stope next below removed with safety, and usually with little loss. It is a great advantage in connecting levels to have the timber sets in exact alinement, both longitudinally and transversely of the vein, on each level, as having the posts stand immediately over each other makes the connection much less difficult and expensive. The proper place for the sills on each level can be easily established by the mine surveyor, and the lines once given on the level there is no difficulty in the timbermen keeping the sets in line, as all the members of the sets are of standard length (or should be), and consequently the sets of one level conform to the position of those both above and below.



Timbering Arrangement for Removing Back

Sills Can Be Put In below Unfilled Stopes

When sills have been omitted at the time the stope was started and the placing of the sets commenced, and it becomes necessary to place them later, this may be accomplished by spragging the posts of the sill floor as tightly as possible, both longitudinally and transversely of the stope, and sawing off the foot of each post at the proper hight and slipping the sills beneath. As a matter of course this cannot be done in a stope that has been even partly filled.

When the stope is still open and it is desired to place the sills as suggested above it may be accomplished in the following manner: The sills should be laid so as to butt against each other at the ends, or they may be framed so that the ends will overlap, by cutting out the upper half of one and the lower half of the other, which will facilitate in no small degree the connection of the stopes. This must be done with great care and should not be left to inexperienced hands. The work must be done in small sections, and begun only after all the sills have been placed in position in the stope. The sills should be as long as it is possible to handle them—not less than two sets long, and three sets would be better. They should be placed across the vein, from foot- to hanging-wall, and the timber should be of good size, as they may be called upon to sustain a greatly increased pressure when the stopes are connected.

The accompanying sketch will give an idea of the method of placing sills in stopes where they have been omitted, and the same method may be successfully applied should it be deemed advisable to replace old and rotten sills with new ones.

Section Liner for Lettering

By B. Bryan*

As a mining engineer who occasionally uses drafting tools, I offer a suggestion in regard to the use of the section liner. In doing some block lettering lately, I found that this instrument is excellent for lettering. None of the draftsmen here had ever heard of this use for that instrument.

In any class of lettering, except fancy free-hand work, the section liner is set so that the space between lines will be one-fifth of the hight of a 4x5 letter, and then when used against a straight-edge, the liner will take care of all spacing, giving a high class of work in less time than it takes to do a poor job after the usual method. In titles or other work of that type, by counting to the center and then working in both directions, a good spacing is obtained with the greatest ease. This will be of value only in lettering of sufficient importance to justify penciling before it is finally inked.

*Mining engineer, Buenos Aires, Argentina.

Deering Plant of American Zinc, Lead and Smelting Company

By Evans W. Buskett*

One of the best equipped and most conveniently arranged zinc smelteries in the eastern Kansas gas belt is the plant of the American Zinc, Lead and Smelting Company, at Deering. It is situated on the western division of the Missouri Pacific railway, about five miles from Coffeyville. The works consist of a crushing and drying plant, three Zellweger roasting kilns and six blocks of retort furnaces for the reduction of the ore. There are also coal crushers, a laboratory and a complete pottery for the manufacture of retorts and condensers. There are a number of producing mines on the 2400 acres of mining land which the company owns in the Joplin district.

The plant has a capacity of between 600 and 700 tons of zinc ore per week, nearly all of it coming from the Joplin district. Part of this ore is bought in the open market but large quantities are shipped each week from the company's mines at Webb City. The production of spelter is 300 tons per week and the daily consumption of gas is 6,000,000 cu.ft. The company employs 250 men in the Deering plant.

The Ore Is Mechanically Handled

The ore is unloaded from the cars into large storage bins from which it is taken as needed to the two driers. The driers are 15 ft. in diameter, with a bottom of iron which is heated from below by mixers. The wet ore is elevated, charged into the drier at the center and worked to the circumference and discharged through a hole in the side by means of paddles or stirrers, which are carried on four radial arms. The dried ore is received by an elevator and carried up to a 10-mesh revolving screen, discharging into a bin from which the ore is taken to the roasters. The oversize goes to a set of rolls and is carried back to the screen.

The three roasting kilns are of the Zellweger type. The furnace is a reverberatory having high sides on account of the peculiar rabbling apparatus. This consists of a roller which is supported at each end by a wheel about six feet in diameter. These wheels run on tracks inside of the furnace and the whole arrangement is pulled through at intervals by means of a wire cable. The roller is provided with paddles which stir the ore as it moves through the furnace.

As the ore is raised very little there is not much loss by dusting, but these furnaces consume a large amount of gas on account of the high sides and consequent large air space to be heated. The burners of this furnace are brick flues about 3 ft. long, having an opening about 10 in. long and eight inches high. They are placed in the furnace at an angle of about 45 deg. to the horizontal. The gas enters through a ¾-in. pipe which projects about six inches into the flue. There are 10 of these burners on each side of the furnace, six about eight feet apart and the four near the discharge end, four feet apart.

*Metallurgical engineer, Joplin, Mo.

Roasting Kilns Reduce the Sulphur from 30 to 1 per Cent.

The furnaces operate satisfactorily, reducing the sulphur content of the ore from 30 per cent. to less than 1 per cent.

The annexed tabulation shows the average work done by these furnaces at Deering.

ROASTING BLENDE IN ZELLWEGER KILNS.

Output, Per Cent.	Sulphur, Per Cent.	Lime, Per Cent.	Fault, Per Cent.
56,030	0.49	0.71	0.08
55,660	0.41	0.63	0.05
50,690	0.48	0.80	0.02
47,580	0.55	0.63	0.19
53,500	0.62	0.60	0.28
53,800	0.54	0.68	0.15

The lime is figured as sulphate and the sulphur left after the lime is satisfied is figured as "fault."

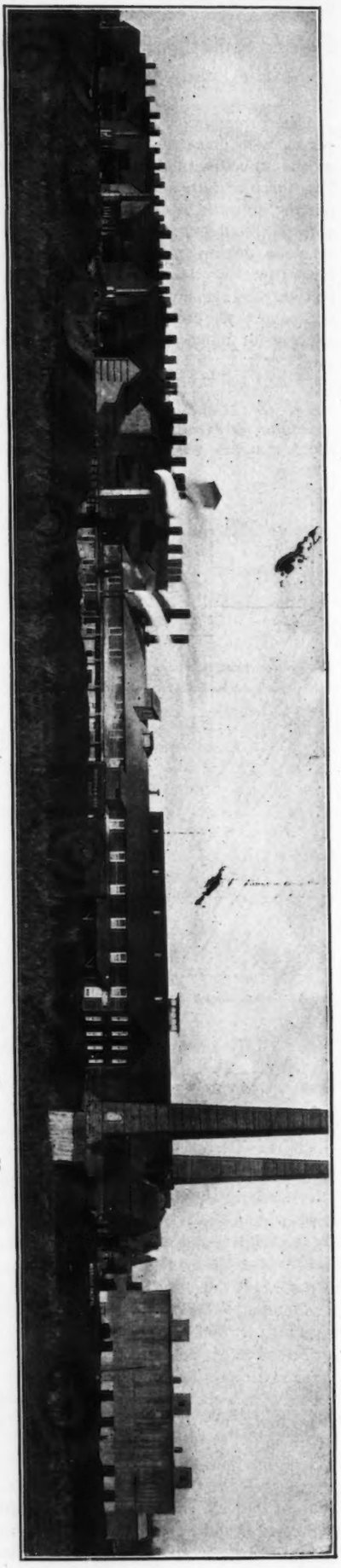
From the roasting kilns the ore goes to the weighing room, where the proper amount for mixing is weighted out into cars. At the weighing house there is a large brick bin which is used for the storage of ore against a breakdown at the roasting kilns. From the weighing room the ore is carried to the mixhouse, where it is mixed with coal. This is done by bedding.

The mixing pits are about six feet square and two feet deep and are paved with brick. At one end is an iron grating along the entire end of the pit. Underneath this grating is a screw conveyer which serves both as a mixer and as a conveyer to the furnace bins. A layer of coal is spread on the floor and covered with ore and so on until the pit is filled. The screw is then started and the mixture is shoveled into the conveyer until the pit is empty, when the operation is completed.

Furnaces Four Tiers High and Contain 320 Retorts

The furnaces are charged by hand. The ore mixture is loaded into a bin which travels on a track in front of the retorts and the ore is shoveled from the bottom of the bin into the retorts. The furnaces are built with their backs together so that one central wall serves for two furnaces. There are 20 sections to a furnace, each containing 16 retorts, making 320 to the furnace or 640 to the block. They are four tiers high instead of five, as in some gas smelteries.

The wages paid at this plant are:



Zinc-smelting Plant of the American Zinc, Lead and Smelting Company at Deering, Kan.

Driers, $2; kilns, $2.50; mixhouse, $2; furnaces, $1.60 to $3; yard, $1.75; engine room, shops, etc., $1.75 to $3; pottery, $1.75 to $3.

The residues remaining in the retorts after smelting are discharged by means of water. A small pipe about 10 ft. long is attached to a hose with a stop cock near the operator's hand. A sheet-iron screen is hung in front of the furnace to protect the man handling the pipe which is poked into each retort through a slot in the screen. As the water comes in contact with the heated retort it explodes, throwing the residues out against the screen, where they fall into the pit beneath the furnaces and are hauled away in cars to the dump.

Data on the De Beers and Premier Diamond Companies

By E. M. Weston*

At the last annual meeting of the De Beers Consolidated Mines, Ltd., the chairman gave out interesting statements with regard to the future of the famous producers of this group of properties. He emphasized the fact that the pipes did not become poorer in depth, stating that the yield from Wesselton, Bultfontein and Dutoitspan is better than in shallower levels, and though the yields from Kimberley and De Beers had fallen off, the Kimberley yield is better now that it was four or five years ago.

Kimberley Pipe Diminishes in Granite But Yield Not Affected

Anxiety has been expressed that the yield would fall off when the pipes entered the granite. He states, however, that the Kimberley mine is now about 3000 ft. deep and although the pipe entered granite at 2500 ft., the yield is maintained and "experience has been that the yield of 'blue' in the mine is not in any way affected by the nature of the containing rock, whether it is shale, melaphyre, quartzite or granite." The fact that granite will perhaps be met with at a depth of about 1200 ft. in Dutoitspan and Bultfontein therefore causes no anxiety.

It has never been denied that the sectional area of the pipes tends to be greatly reduced in depth and there appears to be a probability that the rate of this reduction will be accelerated in the hard granite; but the depths at which the various pipes become of such small sectional area as to be unpayable, has not apparently been nearly approached even in the De Beers and Kimberley mines. Workings on the other pipes are still comparatively shallow.

*Mining engineer, 20 St. Mary's building, Johannesburg.

Yield Satisfactory from De Beers

It appears, however, that in depth the ground is harder and more expensive to treat and mine, while the average value per carat from the De Beers and Kimberley has fallen from 58 to 46s. This, it is admitted, is due to a falling off in value of the stones obtained from the deep Kimberley mine from which a large quantity of floored ground has been treated. It is, however, emphasized that the yield now gained by the direct treatment of the blue ground from the Kimberley mine compares favorably in value per load with that formerly treated. There were, in December last, about 1,000,000 loads lying on the floors, and the stock was reduced to 1,100,000 loads during the previous year. This was owing probably to the partial suspension of underground work during the diamond depression.

Low Prices Due to Overproduction

The price of inferior grades of diamonds has not risen in sympathy with that of higher-priced stones and for this the Kimberley people blame the management of the Premier Diamond Mining Company, Ltd., accusing that company of overproduction and stating that they on their part have reduced their output of low-grade stones from tailings from 557,000 carats in 1904 to 385,000 carats in 1908 and to 61,000 carats in the year ended June 30, 1909. I have already pointed out in an article on the Premier mine[1] that owing to the low value per carat and the low value per load of the output of this mine the only way in which it can be made to return profits is to produce on the largest possible scale.

Financial Conditions of Premier Company.

This condition of affairs is most clearly shown by the annual report of the Premier Diamond Mining Company, Ltd., for the year ended Oct. 31, 1909. The accounts show a profit of £438,811, with diamonds in stock valued at £355,297 as against a profit of £789,936 in 1908 and £875,729 in 1907. Trading and emergency funds of £300,000 and £100,000, respectively, have been created. The report states that the diamond market is in a prosperous condition and that there is every prospect of good and sound business during the coming year. These remarks apparently apply only to better-class diamonds and it is evident that difficulty is experienced in disposing of the lower qualities which form such a large proportion of the production.

The production of the Premier company for the year amounted to 1,872,136½ carats, a decrease of 206,688¾ carats from that of the previous year. The cost per load treated rose to 1s. 11.42d. due to labor shortage and water troubles. The average value per load was 3s. 1.43d., although for the first three months of the current fiscal year it rose to 3s. 3.75d. Even though it is pointed out that the fall in grade took place in 1908, as the value and the carats for that year were really overvalued, it does not make the continued fall any more pleasing to shareholders.

[1]Eng. and Min. Journ., Feb. 12, 1910, page 369.

New No. 4 Gear to Treat Large Tonnage

It was stated that by March or April the completed sections of No. 4 gear would allow the treatment of 850,000 loads per month, and that after November next 1,000,000 loads per month at an estimated cost of 1s. 6d. per load. It is claimed that the No. 4 gear is a success and that its chief feature is the treatment of the crushed ore directly on pulsators or jigs. A new main incline shaft has been started to enable the mine to be worked down to 1500 ft., above which level it is estimated there is 30 years' work in sight.

Premier Cannot Afford to Restrict Output

The South African public have come to expect as a matter of course a display of verbal fireworks and a competition in the production of denunciatory metaphors and similes between the heads of the rival diamond producers at Kimberley and Pretoria; but whoever and whatever may be to blame for the doubtful condition of the diamond market and its reserves, it is at once apparent that the Premier company, having an enormous low-grade deposit, must attempt to work it on the very largest scale in order to procure maximum production at minimum cost. It cannot if it would enter into any agreement to restrict output. If in avoiding the Scylla of high costs it is wrecked and wrecks others on the Charybdis of a falling diamond market it will only have been experiencing the fate that has often overtaken base-metal mines the world over at certain periods.

Drilling Results at South Lake Mine, Michigan

Dr. L. L. Hubbard, consulting geologist for the South Lake Mining Company of Houghton, Mich., in a statement to stockholders regarding the relationship, if any, between the copper-bearing beds disclosed by a diamond drill on the South Lake property, and certain beds found on the Lake property, states that the so called Lake lode and the conglomerate bed exposed about 500 ft. east, strike at the surface nearly north and south, and dip to the west. Their strike and dip is abnormal as compared with other beds in the Kekeenaw series exposed in and near the bluff or ridge a short distance to the north, where the strike is nearly east and west, and dip northerly.

Settling Fine Dust at Copper Queen Smeltery

Experiments Proved That Dust Chambers 125 Feet Long Were Efficient When Gas Velocity Did Not Exceed 150 Feet per Minute

BY GEORGE B. LEE*

A long series of experiments have been conducted on a large scale as regards the quantity of smoke handled at the Copper Queen smeltery. The aim was to see if it was not possible to settle very fine dust out of a current of gases by reducing the velocity. To this end a small flue was built 50 ft. long—afterward increased to 100 ft. long, with an area of 23 sq.ft. The gases were drawn through this flue by means of a fan and then discharged through flannel bags to collect what was not settled in the chamber.

The gases were passed through the chamber at various speeds, from less than one foot per second to over five feet per second. The results of these tests have been plotted in diagrams, some of which are submitted. Approximately 90 per cent. of the dust that settled in the experimental chamber passed a 200-mesh screen.

Meshes of Ordinary Woolen Bags Too Coarse to Retain Finest Dust

In the early experiments it was found that ordinary wool bags would not arrest the finest dust. Microscopic examination showed that a large part of the spaces between the meshes of the cloth were larger than the particles of dust we were trying to recover. After this we used the closest-woven woolen material available. Since the figures are all based on the supposition that what was collected in the flue, plus that caught by the bags, represented all that was in the smoke, it was necessary to be sure the bags let no dust pass.

In the course of the experiments, as the velocity of incoming gases increased, it was found that eddies were set up, which interfered with uniform deposition of dust. We then made experiments with small baffles, one foot square, placed opposite the inlet pipe and about one foot from the inlet. The effect of this small baffle is well shown in diagrams XII-7 and XII-9. Both of these were at a velocity of about 135 ft. per sec. in the inlet.

A Chamber 125 Ft. Long Sufficient to Settle Copper Queen Dust

We believe, as a result of these experiments, that flues or chambers to settle dust need not be long. In fact, 125 ft. would appear to be enough if the velocity of gases through them does not exceed 150 ft. per min., and that this speed may be materially increased if wires or

*Superintendent, Copper Queen Smelting Works, Douglas, Ariz.

DUST CHARACTERISTICS—EXPERIMENT XII—7.

	Amount of Dust Retained.		Composition.			
	Pounds.	Per Cent.	Gold, Ounces.	Silver, Ounces.	Copper, Per Cent.	Lead, Per Cent.
Division I	2,625	3.89	0.04	5.76	14.80	1.4
Division II	28,000	41.50	0.04	4.86	11.60	0.9
Division III	15,000	22.24	0.03	4.17	11.30	1.1
Division IV	12,625	18.72	0.03	4.27	11.00	1.4
Division V	9,188	13.62	0.03	4.27	11.30	1.4
Total	67,438	100.00	....	....	.....	...

DUST CHARACTERISTICS—EXPERIMENT XXII—9.

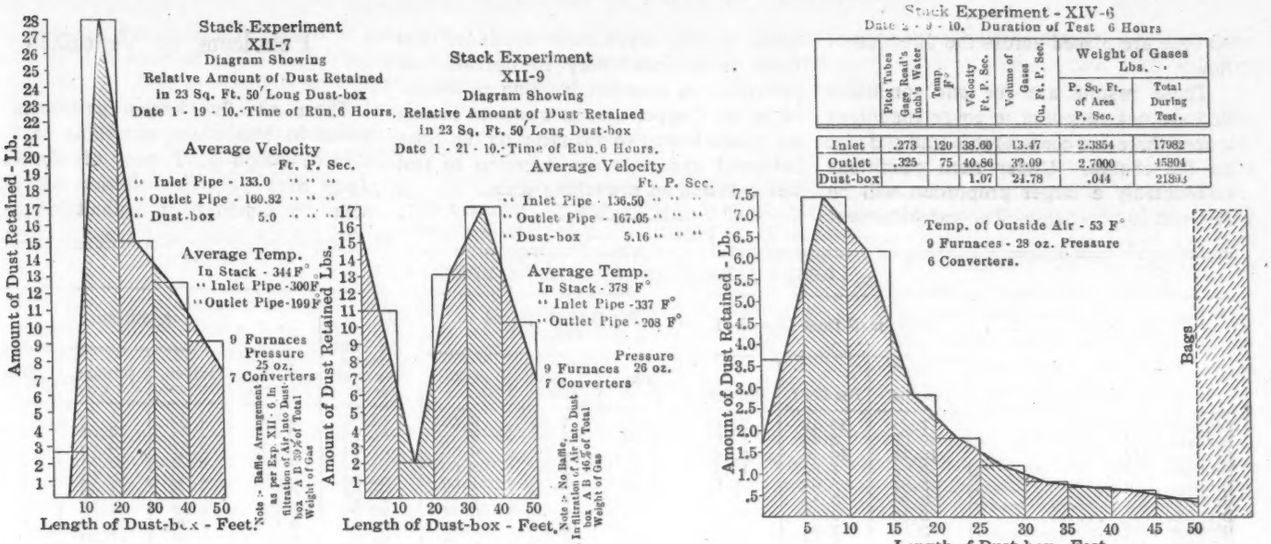
	Amount of Dust Retained.		Composition.			
	Pounds.	Per Cent.	Gold, Ounces.	Silver, Ounces.	Copper, Per Cent.	Lead, Per Cent.
Division I	11,000	20.51	0.02	4.1	12.35	1.1
Division II	2,063	3.85	0.04	5.1	12.95	2.4
Division III	13,125	24.40	0.04	4.6	11.20	1.5
Division IV	17,065	31.85	0.03	3.6	10.65	1.6
Division V	10,312	19.26	0.03	4.1	10.70	1.7
Total	53,560	100.00	....	....	.....	...

DUST CHARACTERISTICS—EXPERIMENT XIV—6.

	Amount of Dust Retained.			Composition.			
	Pounds.	Per Cent.	Per Cent.	Gold, Ounces.	Silver, Ounces.	Copper, Per Cent.	Lead, Per Cent.
Division I	3.625	10.63	14.22	0.02	3.42	10.60	1.7
Division II	7.375	21.63	28.92	0.02	3.37	10.55	1.0
Division III	6.125	17.96	24.02	0.025	3.47	10.90	1.1
Division IV	2.813	8.26	11.04	0.025	3.77	11.00	1.1
Division V	1.812	5.31	7.10	0.02	3.57	10.80	1.9
Diivsion VI	1.188	3.48	4.66	0.02	3.57	11.05	2.1
Division VII	0.812	2.38	3.18	0.025	3.87	11.20	2.1
Diyision VIII	0.688	2.02	2.70	0.025	3.87	11.00	2.3
Division IX	0.625	1.83	2.45	0.03	3.97	11.15	3.1
Division X	0.437	1.28	1.71	0.03	3.97	10.60	2.8
Total in dust box	25.560	74.78	100.00	0.0225	3.52	10.42	1.4
Bag	9.937	25.22	.....	0.01	4.79	5.60	14.4
Grand total	35.437	100.00	.....	0.019	3.84	8.97	4.68

DUST CHARACTERISTICS—EXPERIMENT XV—2

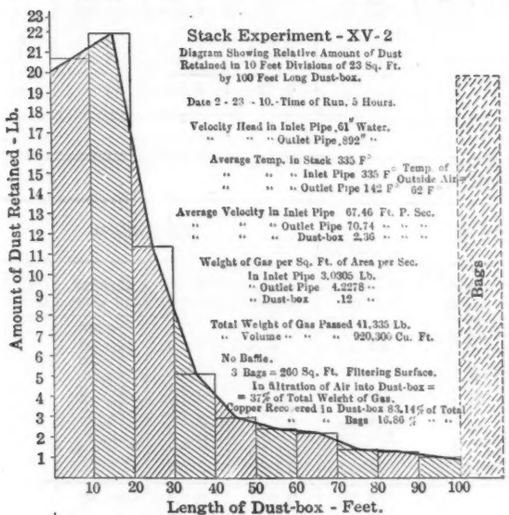
	Amount of Dust Retained.				
	Pounds.	Per Cent.	Per Cent.	Copper, Per Cent.	Lead, Per Cent.
Division I	20.813	22.89	29.30	11.29	0.5
Division II	22.062	24.29	31.09	11.64	0.6
Division III	11.438	12.59	16.11	11.84	0.8
Division IV	5.187	5.70	7.30	10.79	1.0
Division V	3.000	3.30	4.22	10.74	1.5
Division VI	2.438	2.69	3.44	11.44	1.5
Division VII	2.250	2.48	3.17	11.04	2.0
Division VIII	1.437	1.58	2.02	11.04	1.8
Division IX	1.313	1.44	1.85	10.99	2.1
Division X	1.062	1.17	1.50	11.09	2.4
Total box	71.000	78.13	100.00	11.46	0.82
Bags	19.875	21.87	.....	8.33	8.50
Grand total	90.875	100.00	.....	10.77	2.5

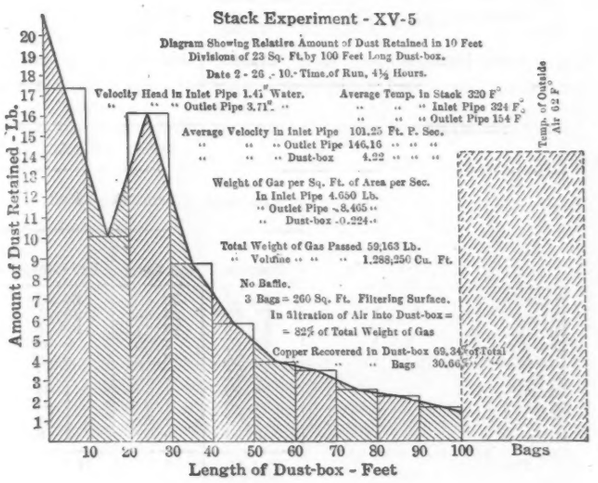

Stack Experiment
XII-7
Diagram Showing
Relative Amount of Dust Retained
in 23 Sq. Ft. 50′ Long Dust-box
Date 1 - 19 - 10. Time of Run, 6 Hours.
Average Velocity
Ft. P. Sec.
" Inlet Pipe - 133.0 " " "
" Outlet Pipe - 160.32 " " "
" Dust-box 5.0 " " "
Average Temp.
In Stack - 344 F°
" Inlet Pipe - 300 F°
" Outlet Pipe - 199 F°
9 Furnaces
Pressure
25 oz.
7 Converters
Note :- Baffle Arrangement as per Exp. XII - 6 In filtration of Air into Dust-box - A Is 39% of Total Weight of Gas
Amount of Dust Retained - Lb.
Length of Dust-box - Feet.
Stack Experiment
XII-9
Diagram Showing
Relative Amount of Dust Retained
in 23 Sq. Ft. 50′ Long Dust-box
Date 1 - 21 - 10. Time of Run, 6 Hours.
Average Velocity
Ft. P. Sec.
" Inlet Pipe - 136.50 " " "
" Outlet Pipe - 167.05 " " "
" Dust-box 5.16 " " "
Average Temp.
In Stack - 378 F°
" Inlet Pipe - 337 F°
" Outlet Pipe - 208 F°
Pressure
9 Furnaces 26 oz.
7 Converters
Note :- No Baffle. In filtration of Air into Dust-box is 46% of Total Weight of Gas
Amount of Dust Retained Lbs.
Length of Dust-box - Feet.

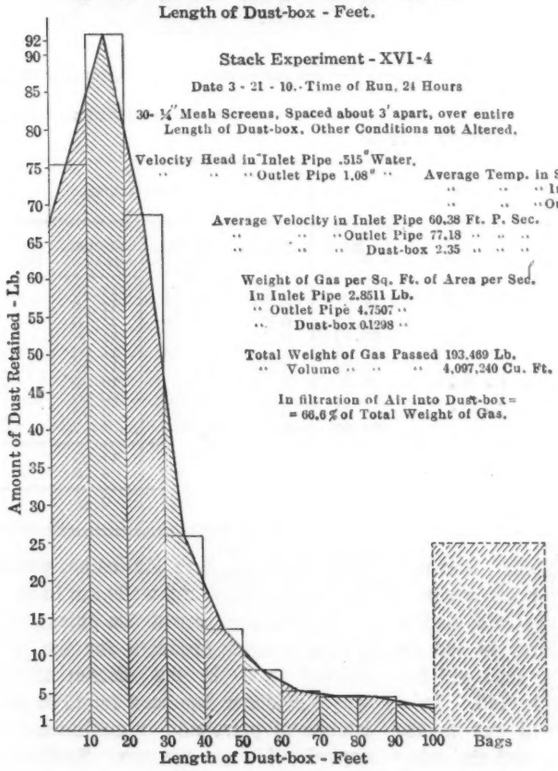
Stack Experiment - XIV-6

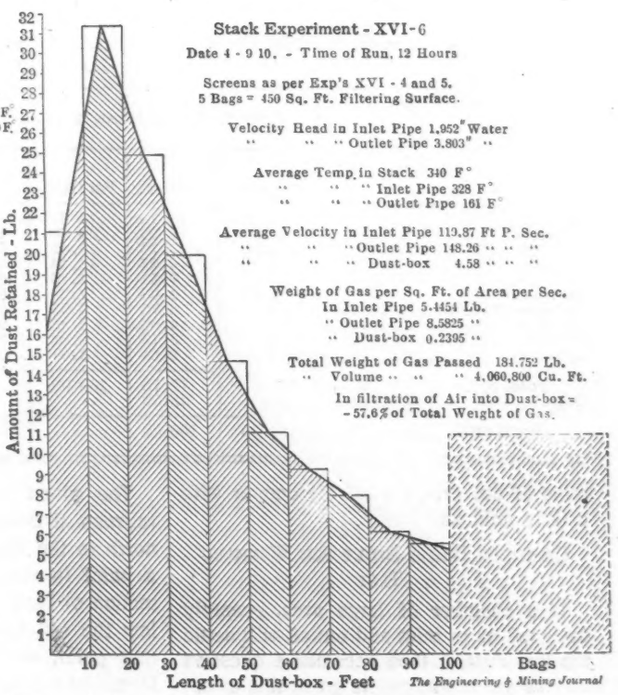
Date 2 - 9 - 10. Duration of Test 6 Hours

	Pitot Tubes Gage Read's Inch's Water	Temp F°	Velocity Ft. P. Sec.	Volume of Gases Cu. Ft. P. Sec.	Weight of Gases Lbs. P. Sq. Ft. of Area P. Sec.	Weight of Gases Lbs. Total During Test.
Inlet	.273	120	38.60	13.47	2.3854	17982
Outlet	.325	75	40.86	37.09	2.7000	45804
Dust-box			1.07	24.78	.044	21395









DIAGRAMS SHOWING RESULT OF EXPERIMENTS IN SETTLING DUST AT COPPER QUEEN SMELTERY

screens are placed across the direction of flow.

These results are for our conditions and are not supposed to cover conditions where there are considerable lead and zinc on the charge. Under such conditions undoubtedly a larger proportion will be retained in the bags. The valuable contents of our ores are mainly copper with a little gold and silver.

Chamber Being Built for Working Test

If a chamber of large area, properly designed as to inlet and outlet, will settle the fine dust, it then becomes a question of how far it will pay to go in this direction. It has the advantage over the bag house or any mechanical appliance that there is no machinery to operate and maintain. A chamber is being constructed at the Copper Queen works to handle the gases from two furnaces on the lines indicated and it is the intention to test this question on a working scale.

DUST CHARACTERISTICS—EXPERIMENT XV—5.

	Amount of Dust Deposited.			Per Cent. Retained on Screen of			Per Cent. Passing 200 Mesh Screen.	Composition.			
	Pounds.	Per Cent.	Per Cent.	100 Mesh.	150 Mesh.	200 Mesh.		Gold, Ounces.	Silver, Ounces.	Copper, Per Cent.	Lead, Per Cent.
Division I	17.31	15.12	24.06	1.00	7.25	8.50	83.25	0.02	2.53	11.10	0.4
Division II	10.00	8.74	13.90	0.88	5.00	8.37	85.75	0.02	2.93	12.20	0.7
Division III	16.13	14.10	22.43	0.88	4.88	6.50	87.74	0.03	2.67	10.80	0.8
Division IV	8.75	7.64	12.16	0.37	2.00	3.50	94.13	0.025	2.92	10.75	0.9
Division V	5.81	5.08	8.08	0.25	0.25	1.50	98.00	0.025	3.02	11.10	1.0
Division VI	3.94	3.44	5.48	0.25	0.37	1.12	98.26	0.025	3.02	11.20	1.0
Division VII	3.50	3.06	4.87	0.00	0.13	0.37	99.50	0.02	2.78	11.35	1.2
Division VIII	2.56	2.24	3.56	0.00	0.06	0.06	99.88	0.02	2.98	11.20	1.3
Division IX	2.25	1.97	3.13	0.00	0.13	0.06	99.81	0.02	2.93	11.20	1.7
Division X	1.68	1.47	2.33	0.00	0.37	0.13	99.50	0.02	2.93	11.00	1.8
Total box	71.93	62.86	100.00	....	.....	.....	91.84	0.024	2.78	11.13	0.83
Bags	42.50	37.14	.....	....	.....	.....	.....	0.01	3.49	8.35	7.5
Grand total	114.43	100.00	.....	....	.....	.....	.....	0.02	3.14	10.09	3.3

DUST CHARACTERISTICS—EXPERIMENT XVI—4.

	Amount of Dust Deposited.			Per Cent. Retained on Screen of			Per Cent. Passing 200 Mesh Screen.	Composition.			
	Pounds.	Per Cent.	Per Cent.	100 Mesh.	150 Mesh.	200 Mesh.		Gold, Ounces.	Silver, Ounces.	Copper, Per Cent.	Lead, Per Cent.
Division I	75.31	20.19	24.84	2.12	14.62	13.25	70.01	0.025	2.42	10.85	0.9
Division II	92.63	24.83	30.55	1.12	8.40	6.25	84.23	0.025	2.52	10.90	0.9
Division III	68.69	18.41	22.65	0.13	0.75	2.00	97.12	0.03	2.72	11.10	1.0
Division IV	26.12	7.00	0.82	0.25	0.62	0.50	98.63	0.02	2.98	10.95	1.7
Division V	13.88	3.72	4.58	0.25	0.25	0.13	99.37	0.04	3.16	10.70	2.8
Division VI	8.31	2.23	2.74	0.25	0.37	0.13	99.25	0.03	3.17	10.40	3.3
Division VII	5.50	1.47	1.81	0.37	0.38	0.25	99.00	0.025	3.27	9.70	3.6
Division VIII	4.56	1.22	1.51	....	.....	.....	100.00	0.025	3.37	9.40	4.5
Division IX	4.63	1.23	1.52	0.13	0.13	0.12	99.62	0.025	3.37	8.75	5.3
Division X	3.56	0.97	1.18	0.13	0.25	0.12	99.50	0.02	3.58	8.00	7.0
Total box	303.19	81.27	100.00	....	.....	.....	86.86	0.026	2.69	10.80	1.39
Bags	69.88	18.73	.....	....	.....	.....	.....	0.02	3.93	4.95	15.9
Grand total	373.07	.....	.....	....	.....	.....	.....	0.025	2.92	9.70	4.1

DUST CHARACTERISTICS—EXPERIMENT XVI—6.

	Amount of Dust Deposited.			Per Cent. Retained on Screen of			Per Cent. Passing 200 Mesh Screen.	Composition.			
	Pounds.	Per Cent.	Per Cent.	100 Mesh.	150 Mesh.	200 Mesh.		Gold, Ounces.	Silver, Ounces.	Copper, Per Cent.	Lead, Per Cent.
Division I	21.12	10.79	13.87	1.5	10.2	6.9	81.4	0.02	2.73	11.50	1.0
Division II	31.50	16.08	20.68	1.5	9.0	8.0	81.5	0.02	2.78	11.55	1.1
Division III	25.00	12.78	16.43	0.38	5.0	5.9	88.72	0.03	2.83	11.40	1.4
Division IV	20.00	10.22	13.14	0.25	2.12	2.5	95.13	0.03	3.02	11.30	1.9
Division V	14.70	7.51	9.66	0.12	0.50	0.87	98.51	0.03	3.18	11.00	2.0
Division VI	11.12	5.68	7.30	0.25	0.37	0.37	99.01	0.03	3.13	11.00	2.5
Division VII	9.25	4.72	6.07	0.12	0.12	0.12	99.64	0.02	3.08	10.60	2.7
Division VIII	7.94	4.06	5.22	0.12	0.12	....	99.76	0.025	3.18	10.20	3.2
Division IX	6.12	3.13	4.02	0.12	0.12	.....	99.76	0.02	2.98	9.55	4.5
Division X	5.50	2.81	3.61	0.12	0.25	.....	99.63	0.02	2.98	8.95	6.5
Total box	152.25	77.78	100.00	....	.....	....	90.66	0.025	2.92	11.05	1.95
Bags	43.50	22.22	.....	....	.....	.....	.....	0.01	3.08	4.00	20.7
Grand total	195.75	100.00	.....	....	.....	.....	.....	0.022	2.95	9.48	6.12

The plans of the Alaska Northern railroad at Seward call for its extension north to the Matamiska coalfield, and to a point in the Susitna river in the direction of Haiditarod. The road will follow the old survey to mile 146. From that point, one branch will run to the Matamiska field, 38 miles, and the other branch toward Haiditarod.

Petroleum in Venezuela

There are five known petroleum deposits in Venezuela, according to U. S. Consul Ralph J. Totten, of Maricaibo. They are: (1) The district of Mara, near the Limon river asphalt lake; (2) at Bella Vista, near Maricaibo, where oil has been located and wells are to be sunk in the near future with the object of supplying refined products for the nearby market; (3) in the district of Sucre, where evidence has been found of the existence of petroleum in conjunction with asphalt; (4) on the river Sardinate, in Colombia, near the Venezuelan frontier.

Oil is being produced and refined at the wells at this point at present and being marketed at nearby Colombian cities. (5) south of Lake Maracaibo, in the district of Colon, State of Zulia; this seems to be the largest and most conveniently situated of the oilfields.

Deposits South of Lake Maracaibo of Chief Interest

A company of Maracaibo business men, who have control of this field south of Lake Maracaibo, are stated to be about to begin an active campaign for the interesting of foreign and domestic capital in the exploitation of this property. The company has an advantageous contract with the Venezuelan government, which grants it free entrance for its machinery, drills and supplies.

These oilfields can be reached by light-draft lake and river steamers passing up the Catumba river to the Tarra, about 30 miles beyond Encontrados, then about 50 miles by the latter river to La Paloma. The oil-bearing territory extends from this point nearly to the Colombian frontier.

Evidence of Deposits

On some rugged hills, 40 or 50 m. above the level of the river, abundant evidences of the presence of petroleum are said to be found. About 20 small streams have sources on these hills and the waters of these streams are constantly covered with a thick scum of petroleum. The oil comes from springs, and some from fissures, along the banks of the streams. In places the surface of the ground is covered with a deposit of tar sufficiently thick to destroy vegetation of all kinds.

Conditions Favorable for Exploitation

The forests in this region contain great quantities of wood suitable for construction, and the land is sufficiently sloping for the laying of pipe lines to the river port, La Paloma, where it is planned to place a refinery. Venezuela alone consumes about 1,000,000 gal of kerosene which is sold at a price seldom lower than 42c. per gal. A good home market would, therefore, be available, and oil could be shipped to all of the Venezuelan and Colombian seaports and to the interior of both republics by both rail and water combined.

Distillation Tests of Oil

The crude oil found is of two classes. One is thin enough to flow readily, having specific gravity of 0.8837 at 15 deg. C. The other is quite thick and of the color and consistency of coal tar. Both have an asphaltic base. A distillation test of the thin oil gave the following results: Between 0 and 120 deg. C., 0.5 per cent.; between 120 deg. and 170 deg., 0.5 per cent.; between 170 and 235 deg., 14 per cent. (illuminating); between 235 and 270 deg., 28 per cent. (illuminating); between 270 and 370 deg., 51 per cent. (lubricating); coke, 6 per cent. The product between 170 and 235 deg. flashes at 62 deg. C., and that between 235 and 270 deg. at 83 deg. C. The viscosity of the lubricating oil is twice that of water. Thick oil gave the following distillation results: Water, 28 per cent.; between 0 deg. and 310 deg. C., none; between 310 and 370 deg., 61 per cent. (lubricating); coke 11 per cent.

The Terry Core Drill

The Plainfield Mining Company, Plainfield, N. J., under date of Aug. 8, 1910, gives the following details concerning the drilling of a 235-ft. hole with a Terry Core drill:

The work was carried on under disadvantagous conditions, it being necessary to haul not only fuel but also water to the drill, this item increasing the daily charge $4. Even under these conditions the actual cost was less than $1 per foot. Two men operated the drill, working nine hours per day.

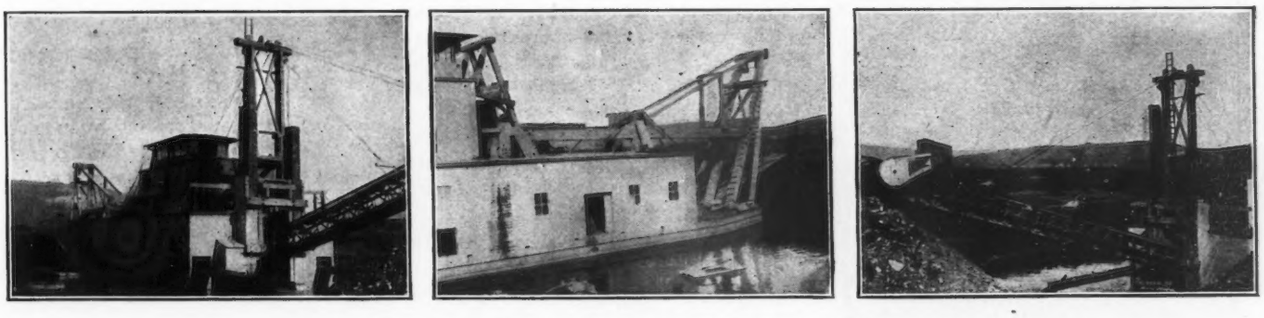
The tools used were the regular 3¼-in. drill which cut a 4-in. hole and removed a 2⅞-in. core. No close record was kept of the percentage of core recovered, since the company was not interested in the quality of slate overlying the ore, but in the last day's run from the 14 ft. drilled, 13 ft. of core were obtained.

DAILY RECORD OF A 3¼-IN. TERRY DRILL.

Date.	Material.	Daily Advance.
		Ft.
July 19	Earth 4 ft. Slate 19 ft.	23
July 20	Slate and small particles pyrites	36
July 21	Slate and small particles pyrites	15
July 22	Slate and small particles pyrites	13
July 23	Slate and small particles pyrites	13
July 25	Slate and small particles pyrites	24
July 26	Slate and small particles pyrites	15
July 27	Slate and small particles pyrites	22
July 28	Slate and small particles pyrites	14
July 29	Slate and small particles pyrites	18
July 30	Slate and small particles pyrites	15
Aug. 1	Slate streaked with pyrites	13
Aug. 2	Slate streaked with pyrites	14
	Total	235

Gold Dredges on the Seward Peninsula

A number of new dredges have been added to the gold-mining equipment of Seward peninsula this summer. The cost of this additional machinery, which has been distributed among the many camps, is estimated at $700,000. Estimates of the unmined gold in low-grade gravels of the peninsula vary from $250,000,000 to $500,000,000. The former figure was reckoned two or three years ago by Alfred H. Brooks, chief of the division of Alaskan mineral resources, U. S. Geological Survey, and thought by Nome mining men to be over-conservative.



Views of a Dredge Operating Near Nome, Alaska

Dredging Operations Successful

Owing to the level character of most of the placer ground on the peninsula, hydraulicking can seldom be carried on; dredging seems to be the only practicable method for the extraction of the wealth contained in the gravels. This means of recovering the gold has been adopted with marked success. A few dredges have been operated through several seasons, and returns have been large on the investment they represent. In spite of the high price of fuel ($20 per ton) the cost of operation does not average, including overhead charges, over about 18c. per cubic yard. Only unfrozen ground is dredged on account of the high cost of thawing. There are said to be extensive

areas available for dredging where the ground runs over 50c. in gold per cubic yard. Several types of dredges are used, the accompanying illustrations being made from photographs taken at a plant about three miles from Nome.

DETAILS OF CONSTRUCTION

The illustrations shown give an idea of the constructional details of one type of dredge. The dredge is similar to those now generally used in California, i.e., it is a spud-anchored boat, provided with tailings sluices and a belt-conveyer, tailings stacker; the machinery is electrically operated. The framing of the gauntrees and spud casing is shown plainly in the photographs.

Another illustration published herewith shows the clean-up arrangement at a placer mine a few miles from Nome. The material to be washed is dumped from

CLEANING UP AT A PLACER MINE NEAR NOME

the aërial tram into the bin, from which it is drawn into the sluice boxes. The men are shown cleaning up the sluices.

Caledonia Mining Company

The Caledonia company in a letter to stockholders announces that on account of the forest fires that have been raging in the Cœur d'Alene mining district for the last six weeks, it has been impossible to get the necessary supplies and equipment to handle the work of driving the new lower tunnel of the Caledonia mine. However, conditions are improving and it is expected to have this work in progress in a short time.

During July, ore to the gross value of $55,000 was shipped. After deducting freight, treatment, assaying, sampling, etc., this ore netted about 60 per cent. of the gross value. During the month the mine was closed three days for the celebration of the Fourth and four days on account of a broken hoist.

In August considerable annoyance was experienced on account of forest fires near the property, but it is now believed that all danger from this source is past. The railroads have been more or less hampered from this source, and at times it had been impossible to secure cars at the nearest loading station, this necessitating hauling most of the ore to Kellogg; this will increase the expense of hauling for August. The work during the month was, however, satisfactory in the mine and it is claimed that the production will be larger than for July.

Loss of Oxygen in Hydraulic Air Compression

BY OLIN H. LANDRETH*

The loss of oxygen in hydraulic air compression, mentioned in connection with the compressed air supplied to Cobalt mines, is due to the well known fact that water will absorb different amounts of different gases just as it dissolves different weights of different soluble materials.

ABSORPTION OF OXYGEN AND NITROGEN IN WATER

For oxygen and nitrogen, the accompanying table gives the approximate percentage by volume absorbed to the absorbing water. This is stated for normal pressure or one atmosphere; for other pressures the weights of oxygen absorbed increase in approximately direct proportion to the pressure, but as the density also increases as the pressure, the volumes (as measured under the varying pressure) are about constant.

PERCENTAGE OF GASES ABSORBED TO VOLUME OF ABSORBING WATER—PRESSURE, ONE ATMOSPHERE

Temperature, Deg. C.	Oxygen, Per Cent.*	Nitrogen, Per Cent.
0	1.027	1.856
5	0.891	1.630
10	0.787	1.450
15	0.704	1.307
20	0.635	1.191
25	0.575	1.096

*These are true percentages; ratios are 1|100 of the above percentages.

The figures given in the absorption table are for atmospheric oxygen and nitrogen, not single, separate gases. They therefore represent conditions just as one would find them in hydraulic compression. The table shows that water absorbs from 80 to 90 per cent. more nitrogen from the atmosphere than of oxygen.

OXYGEN ABSORBED MORE READILY THAN NITROGEN

If, however, these tabular percentages be divided by 0.21 for the oxygen and by 0.79 for the nitrogen, being the proportions of each gas in one cubic foot of air, it is seen that for the same volume of gas offered for absorption, oxygen is absorbed more than twice as fast as nitrogen, and the composition of the air taken up by the water is richer in oxygen than the original air. As the absorbed air is mostly carried away by the water flowing from the uptake shaft, the air which remains and which is used for industrial purposes is poorer in oxygen than the original air. The absorbed air is largely given up from the water, but only after the water has risen in the uptake till the pressure is reduced, and even then is largely held in minute globules which give the water a milky appearance.

PER CENT. OF GAS CONTAINED IN A GIVEN VOLUME OF AIR ABSORBED BY THAT VOLUME OF WATER.

Temperature, Deg. C.	Oxygen, Per Cent.	Nitrogen, Per Cent.	Ratio, O : N.
0	4.89	2.35	2.08
5	4.24	2.07	2.05

*Dean of engineering, Union College, Schenectady, N. Y.

Flue Dust Utilization at Pittsburg

PITTSBURG CORRESPONDENCE

The Carnegie Steel Company is erecting at Duquesne, Penn., near the Duquesne steel works and blast furnaces, a plant which is expected to briquet about 400 tons of fluedust daily. The plant will operate under the American Grondal patents, a license having been taken out from the American Grondal Kjellin Company, New York. The Grondal process avoids the use of a binder, such as lime, pitch, tar, etc., often tried, which has not proved effective, because the binder is dissipated by the heat in the upper part of the blast furnace or is attacked by the reducing gas. Instead of using a binder the process compresses the dust slightly when in a moist state, subsequently passing the briquets on cars through a kiln, where they are exposed to an increasing temperature in an oxidizing atmosphere.

A 60-PER CENT. IRON PRODUCT

The Carnegie plant at Duquesne will work upon the current product of fluedust from the Steel Corporation furnaces in the general Pittsburg district and will probably also operate upon some accumulations which have been preserved. The process to be employed is expected to eliminate all coke and volatile matter, thus producing briquets containing more than 60 per cent. iron. On account of its purity it is expected that at least a part of the product will be used in open-hearth steel practice.

It is stated that 75 Grondal briquetting kilns are in operation, chiefly in England, Spain, Italy, Sweden, Norway and the United States, producing more than 1,000,000 tons of briquets annually.

Comparison of Gyratory and Jaw Crushers

Gyratory a Machine of Greater Weight, Capacity and Installed Horsepower; Blake Requires Less Space and Repairs; Both Should Be Used

BY H. L. WOLLENBERG*

The jaw and gyratory crushers are the two distinct types of crushers extensively used for the preliminary reduction of rock and ore. The well known Dodge and Blake crushers are the best examples of the jaw type and have been widely used for many years. Aside from some modifications in the method of applying the thrust and in the construction of the frame, these machines as built today are similar to the early designs. The gyratory type of rock breaker was introduced about 1885. Its large capacity was its most attractive feature and led to its rapid introduction. The early designs were faulty in many features. There is an improved design which has become more or less standard with the several manufacturers. This is the suspended-shaft, two-arm-spider, drop-bottom type with cut-steel bevel gears, forced oil circulation, manganese-steel crushing head and concaves.

Since it is possible to purchase either type of crusher in almost any size and with the assurance that the design and construction are adequate for the work intended, the choice of type can be made strictly on the basis of suitability and economy. There are fads in machinery as well as in millinery. The rapid development of the gyratory crusher and its success in meeting severe requirements have led many to advocate the complete retirement of the jaw type. It is the purpose of this paper to show that each type has a field in which it is superior, and to define the limits of each. There are certain advantages and disadvantages that are inherent in each type of machine, irrespective of size or service, and these are generally fairly well recognized. Of greater importance, and less generally appreciated, are the characteristics of each machine for a particular size and service.

Table 1 has been prepared to show at a glance the comparative features of the two types over a wide range of sizes and services. All the machines quoted in the table, except the two largest sizes of gyratory crushers, are standard sizes. The weights, capacities, required power, etc., are those guaranteed by the manufacturers for average conditions with hard friable rock. The machines quoted in the table to deliver a certain-sized product are the medium sizes adapted to that product, as both larger and smaller machines, within small limits, could be adjusted to produce a certain size of material. The particulars of the 36x282-in. and the 42x345-in. gyratory crushers are only approximate, as the largest standard size manufactured is 24x198-in. Gyratory crushers larger than 24x198 in. have been built to special design.

TABLE 1. COMPARATIVE FEATURES OF JAW AND GYRATORY CRUSHERS.

Crushing from	7 to 1½ in.		10 to 1¾ in.		12 to 2½ in.		18 to 3½ in.		24 to 5 in.		36 to 12 in.		42 to 16 in.	
Type of crusher	Blake	Gyratory	Blake	Gyratory	Blake.	Gyratory.	Blake.	Gyratory.	Blake.	Gyratory.	Blake.	Gyratory.	Blake.	Gyratory.
Size of feed opening in inches	10x7	7x56	20x10	10x80	24x12	12x88	36x18	18x136	36x24	24x198	42x36	36x282	60x42	42x345
Capacity in tons per hour	4	7	12	30	25	70	60	130	85	400	160	900	300	1200
Weight in tons	4	8	9	18	15	24	29	50	30	95	55	200	100	300
Hourly capacity ÷ tons weight	1	0.87	1.25	1.66	1.67	2.91	2.07	2.60	2.83	4.22	2.90	4.5	3	4
Installed horsepower	8	12	20	25	30	50	65	90	65	150	100	200	150	250
Hourly capacity, installed H.P.	0.5	0.58	0.60	1.20	0.83	1.40	0.92	1.44	1.31	2.67	1.60	4.5	2	4.8
Height in feet (discharge spout to feed floor)	3	5½	3	7½	5	8	6	10	6	15	7	23	8	26
Width in feet (including the pulleys)	6½	10	7	13	8	13	13	13	13	20	13	27	15	30
Length in feet (overall)	5½	5	9	6	10	6	12	12	12	12	15	18	16	21

Size of Feed

Inspection of the compiled and calculated data in Table 1 reveals the following interesting comparisons: It develops that in each case the gyratory is a machine of greater weight, capacity and horsepower than the Blake crusher for the same size feed and product. The feed opening of the Blake type is rectangular, that of the gyratory is necessarily the segment of a ring. From this fact it follows that the weight and capacity of a gyratory crusher will increase more rapidly with an increase in the width of the receiving opening than will the Blake type. In other words, we may vary the width or the length of the feed opening in the Blake type independently of each other, while in the gyratory type the width of the feed opening controls the entire design, and the whole machine must be proportioned accordingly. This is an important characteristic and has great influence in defining the field of each type.

Weight, Capacity and Horsepower

Table 2, which is computed from the data given in Table 1, indicates a notable superiority of the gyratory type as regards efficiency of power consumption and capacity per ton weight of crusher. In all cases tabulated, except the first (crushing from 7 to 1½ in.), the relative capacity of the gyratory is greater than either the relative weight or required power. Referring to the third column of Table 2, it appears that in this case the weight of the gyratory is 1.6 times that of the Blake crusher for the same size feed and product, but the capacity of the gyratory is 2.8 times that of the Blake, and the relative power required is only 1.66. This comparison between the two types is also emphasized by the values of capacity per installed horsepower which were computed for Table 1. The gyratory is shown to vary from 0.58 ton per hour per installed horsepower, in the smallest size tabulated, to 4.80 for the largest size, while the Blake has the values 0.50 to 2 for the same conditions. The greater duty per installed horsepower in the gyratory type is due to several reasons. A jaw crusher must break a rock by simple compressive force, high stresses being obtained by impact. The gyratory has the advantage of break-

*Mining engineer, Juneau, Alaska.

ing a large number of pieces by beam action because of the concave shape of the shell and the convex shape of the crushing head. This action introduces both compressive and tensile stresses in the piece of rock, causing it to break with less exertion of force because the tensile strength of rock or ore is only a fraction of its compressive strength.

The gyratory is more economical of power owing to its continuous action. A jaw breaker consumes a large amount of energy in overcoming the inertia of the heavy and rapidly reciprocating parts. Another feature which helps to account for the relatively large amount of power that is installed for Blake crushers is the intermittent character of the work. The demand is irregular, and may temporarily far exceed the average, so a crusher of the jaw type must be liberally equipped with power.

Comparison of Operating Advantages

Reference to Table 1 shows the marked advantage of the Blake over the gyratory type as regards the hight of crusher. This is an important item, as it controls the hight of buildings. In addition to the greater actual hight of the gyratory it requires much clear headroom both above and below the machine for the necessary raising and lowering of the parts. The floor space occupied is about the same for either machine for a certain size feed and product.

The concave shape of the rigid shell of the gyratory, resulting in breaking some of the rock by beam action, causes the material to be more cubical in form than the product of a jaw crusher. For this reason the gyratory usually gives the most uniform product from a given ore or rock.

Other conditions being equal, there is less actual wear on the liners of a jaw crusher, because the tendency toward a certain grinding action cannot be entirely eliminated from the gyratory type. Owing to the conical shape of the concave liners of a gyratory they cannot be reversed when worn at the bottom. The plates for a jaw crusher can be arranged to be turned end for end when the lower part becomes badly worn. For these reasons the renewals for the gyratory type are a greater expense than in the jaw type.

Provided the feed is previously reduced to proper size, attendance is the same for one machine of either type, which gives an important advantage to the gyratory in those cases where its larger capacity enables it to replace two or more jaw crushers.

Repairs

Repairs are more difficult to make, and possibly more frequent, with the gyratory type. The critical mechanical feature of the gyratory is the eccentric drive on the lower end of the main shaft. With hard rock and heavy feeding it requires efficient lubrication to keep the bearings cool. A well designed Blake crusher is easier to keep in order. The introduction of steel castings for the main frame of the jaw crushers has increased the strength and lessened the weight of that important part. As regards vibration during operation the gyratory is superior, as it runs very steadily.

The consideration of relative merits for a specified capacity, and the comparisons drawn therefrom are all on the basis of a given size of feed and product. It would be desirable to compare the two types on the basis of given capacity as well as size of feed and product, but this is not possible. When we designate the feed and product, the size and capacity of the appropriate crusher of each type is determined thereby, and these vary widely for the two types. The bearing that the required capacity has upon the comparison of merits, although left for the last, is all important, as will be shown.

Consider the case in the first column of Tables 1 and 2. This is the only case of those tabulated in which the gyratory does not excel in capacity per ton weight of machine. If, however, a particular installation required the capacity afforded by the 7x56-in. gyratory (seven tons per hour), it might be selected in place of two 10x7-in. Blake crushers, because of the economy of one machine, one foundation, and one attendant. If, however, advantages are to be gained, as in small stamp mills, by dividing the work between several small crushers so as to avoid conveying the crushed material and gain bin storage without additional hight, two small Blake crushers might be selected in preference to one gyratory. It should be noted that the relative weight of the two types is not an exact index of the relative first cost, because the gyratory crushers are sold at a higher price per pound than the Blake type. There are other factors affecting first cost besides the price of the machine at the manufacturer's works.

Rock Breakers vs. Bulldozing

Referring to the last columns of the tables, there is a most interesting case which is not generally well understood. We are dealing with large receiving openings and coarse crushing. During the last few years a demand has arisen for crushers of this magnitude in order to introduce economies in the mining and milling of ores. It has long been recognized that rock breaking is cheaper than stamp milling down to a size of about one inch, and now it is beginning to be understood that rock breaking is cheaper than bulldozing and sledging pieces several feet in each dimension. This, of course, applies only to large-scale operations where the amount to be handled and the transportation equipment render such an installation feasible. To show the economies possible in this direction it may be noted that at the Treadwell mines in 1903[1] the amount of powder used in stoping was 0.34 lb. per ton of ore mined, while it required 0.85 lb. per ton mined to bulldoze this rock after it was stoped. It required one man breaking rock for each machine drill. Much labor was necessary on the feed floor of the crusher. The gyratory crushers in use did not receive large pieces. It is understood that improvements in this direction are now planned.

Returning to the tabulated features of the crushers with large feed opening, one is impressed at once with the enormous capacity and colossal size of the gyratory machines for this class of work. While the calculations show that the gyratory

TABLE 2. RELATIVE WEIGHTS, CAPACITIES AND HORSEPOWER.
The Blake Crusher being taken as unity in each case.

Crushing from....	7 to 1½ in.	10 to 1¾ in.	12 to 2½ in.	18 to 3½ in.	24 to 5 in.	36 to 12 in.	42 to 16 in.
Relative weight of gyratory.....	2.0	2.0	1.60	1.72	3.16	3.65	3.00
Relative horsepower of gyratory.....	1.50	1.25	1.66	1.39	2.32	2.00	1.68
Relative capacity of gyratory....	1.75	2.5	2.80	2.17	4.72	5.62	4.0

TABLE 3. SIZE ANALYSIS
Crushing Plant designed for 125 tons per hour

	Tons per Hour between			
	36 and 12 in.	12 and 3 in.	3 and 1¾ in.	1¾ in and under
Run of mine	55	40	15	15
Feed to first crusher	55	..	..	..
Product of first crusher	..	30	15	10
Feed to second crusher	..	70	..	..
Product of second crusher	..	..	30	40
Feed to third crusher	..	..	60	..
Product of third crusher	..	..	..	60

[1]The Treadwell Group of Mines, Douglas, Alaska, by R. A. Kinzie, *Trans.* A. I. M. E., 1903.

crushers in these sizes have marked advantages in efficiency, their tremendous size and cost are prohibitive unless their large capacities can be utilized. The 36x282-in. gyratory is estimated to have a capacity of 900 tons per hour to a 12-in. product, and the 42x345-in. 1200 tons per hour to 16-in. It would be a remarkable mining or quarrying operation that would furnish large material at such a rate, and that is why we do not hear of gyratory crushers of such dimensions. Some machines have been built larger than 24x198-in., but they are not likely to come into general use. On the other hand the large Blake crushers are commonly built and successfully installed. Their capacity is usually in excess of the requirement but, as is evident from Table 1, not to the prohibitive extent that is true of the gyratory type.

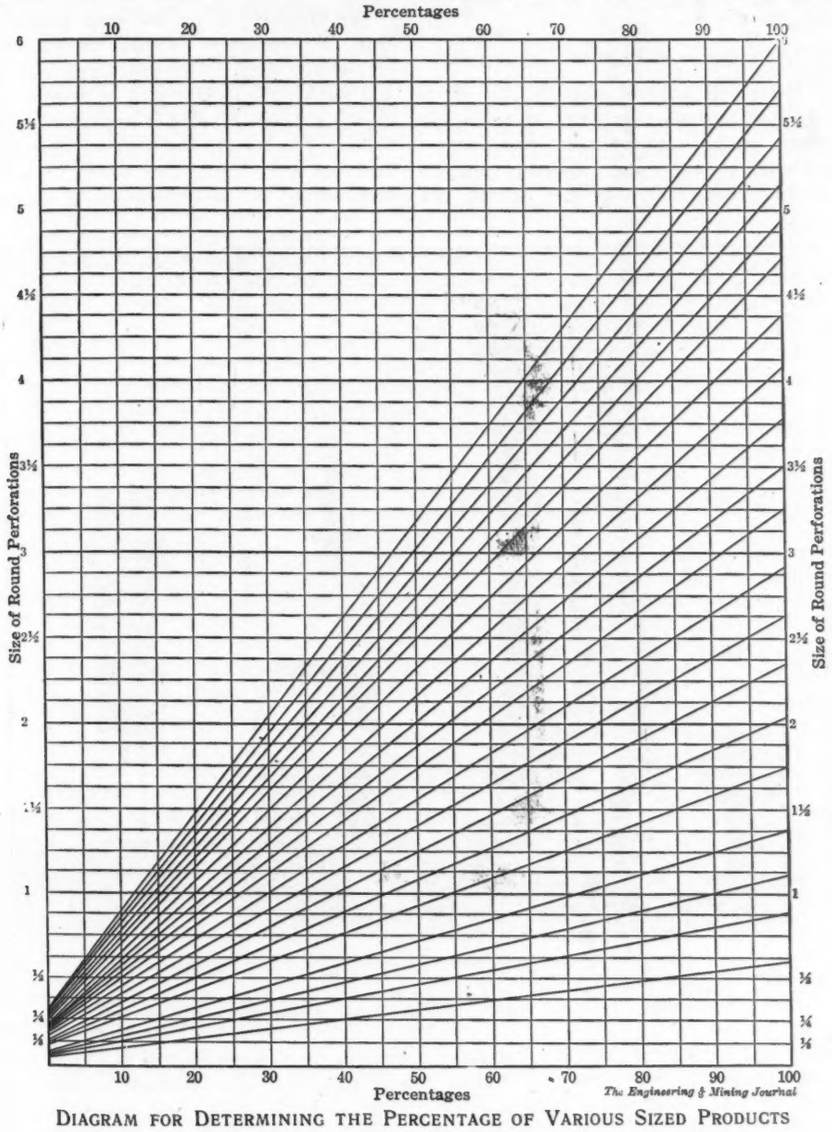


DIAGRAM FOR DETERMINING THE PERCENTAGE OF VARIOUS SIZED PRODUCTS FROM ROCK CRUSHERS

CRUSHING PLANT FOR 200-STAMP MILL

As an illustration of the application of the preceding data and conclusions, the design of a crushing plant for a 200-stamp mill will be considered. Assume a wide body of hard ore, which can be mined cheaply if the ore does not have to be blasted beyond what is necessary to break it from the solid, and adequate transportation facilities are provided to convey the large material to the crushing house. I further assume that a knowledge of the character of the vein and the general conditions of mining are such that it will be desirable to provide for receiving pieces up to 36x42 in. Assume that the stamps have a capacity of 5 tons per day, then for the 200-stamp mill 1000 tons per day crushed to pass a 1¾-in. ring (equivalent to 1¼-in. cube) must be delivered by the proposed crushing plant. It is apparent that the ore must be crushed in stages. Since the initial crushers of large receiving opening will of necessity have a large capacity, it will be best to concentrate the crushing into one 8-hour shift, thus introducing economies in operation. This calls for a crushing capacity of 125 tons per hour.

In Table 3 the distribution of sizes in run-of-mine ore is obtained from experience. The percentages of the different sized particles in the product delivered by any particular crusher may be found by consulting the diagram shown in Fig. 1. For example, when crushing to pass a 6-in. ring, 81 per cent. will pass a 5-in. ring, and about 20 per cent. will go through a 1½-in. ring. This diagram was constructed by the Power and Mining Machinery Company, and is stated to be the result of the compilation of a large amount of experimental data. The results obtained are stated to have been uniform, and the diagram is recommended to be used to determine the percentages of certain sized products from any crusher, roll, or screen. The diagram is approximately correct for hard friable ore, and proper allowance must be made if the rock has any inherent tendency to break in a certain way.

BLAKE PREFERRED AS INITIAL CRUSHER

Taking the required capacities and duties as arrived at in Table 3, and referring to Table 1, it is apparent that we would select the 42x36-in. Blake crusher for the initial breaker. This machine has excess capacity over what is required, but not such enormous excess cost and capacity as a gyratory for the same work. For the secondary crushing one 12x88-in. gyratory is strikingly superior, as it would require three 24x12-in., or two 40x12-in., or two 36x18-in. Blake crushers for the same capacity. For the final crushing two 8x60-in. gyratory crushers would be indicated.

If the ore formation and conditions of mining and transportation were such that an initial crusher to receive pieces 24x36-in. was sufficiently large, it would be found, upon making a size analysis similar to that shown in Table 3 for 36x42-in., that one 36x24-in. Blake machine crushing to 4-in., followed by two 10x80-in. gyratory crushers each giving a product to pass a 1¾-in. ring, would meet the conditions.

In an installation of the size considered above, the crushing plant would be separate from the mill, the crushed product being delivered to the ore bins by conveyers. The large initial crusher must have a solid foundation, preferably resting directly on the ground. The large pieces to be handled make it imperative that the ore be dumped into a receiving hopper that feeds directly to the large crusher. If a gravity-plant site is not available or desirable, there is no difficulty in elevating the product of the initial crusher for further reduction.

The conclusions reached above are in accordance with the most advanced practice. The economy of breaking by crusher over bulldozing and sledging is beginning to be appreciated. Recent installations in South Africa employ large Blake crushers for initial breakers, followed by gyratory machines preliminary to stamp milling. A notable installation in the

United States is that of a 60x42-in. Farrell-Bacon jaw crusher capable of breaking down to 16-in. the largest pieces of hard iron ore that can be handled by a 70-ton steam shovel. Other plants where economies have been secured by introducing large initial crushers of the Farrell-Bacon jaw type are the Granby mines, Phœnix, B. C[1]., the British Columbia Copper Company and the Natomas Consolidated of California[2].

In conclusion it may be said that while each type has a field in which it is superior, no sharp lines can be drawn because of the many factors involved. It is believed, however, that with the aid of the data here presented an investigation along the lines indicated will quickly indicate the most desirable machine for any particular service.

Production of Ammonia by Synthesis

By Alfred Gradenwitz*

Owing to the rapid increase in the demand for combined nitrogen, the manufacture of ammonia from nitrogen and hydrogen may attain a position of industrial importance. The production of ammonia from its elements has been considered impossible from a technical point of view, as the well known inertness of nitrogen at low temperature and the limited affinity between this element and hydrogen at high temperatures seemed to exclude any possibility of practical success. However, Doctor Haber, professor at the Karlsruhe Technical High School, in a series of experiments, carried out with the assistance of R. Le Rossignol, secured the immediate combination of the two elements by employing great pressure.

The result of the experiments indicated that it was practicable to use working pressures as high as 200 atmospheres and that a suitable speed of reaction would be obtained at such high pressures.

Complete Combination of Hydrogen and Nitrogen Obtained

Complete combination of the elements is readily obtained by means of a circulation under high pressure in a closed cycle consisting of a reaction vessel, a precipitation vessel, and a circulation pump. After being liquefied by moderate cooling in the precipitation vessel, the ammonia can be drawn off in a liquid or gaseous condition, leaving the unused amounts of nitrogen and hydrogen behind in the cycle.

The accompanying illustration represents a high-pressure circulation apparatus used by Professor Haber at a recent lecture. It can be operated continuously at a pressure of 185 atmospheres, producing 90 grams of liquid ammonia per hour. The reaction vessel can be provided with a heat regenerator, which becomes more important as the temperature of the reaction increases. Instead of discharging the ammonia by liquefying, it may be drawn off by absorption, either under the same high pressure or after a convenient expansion of the gases.

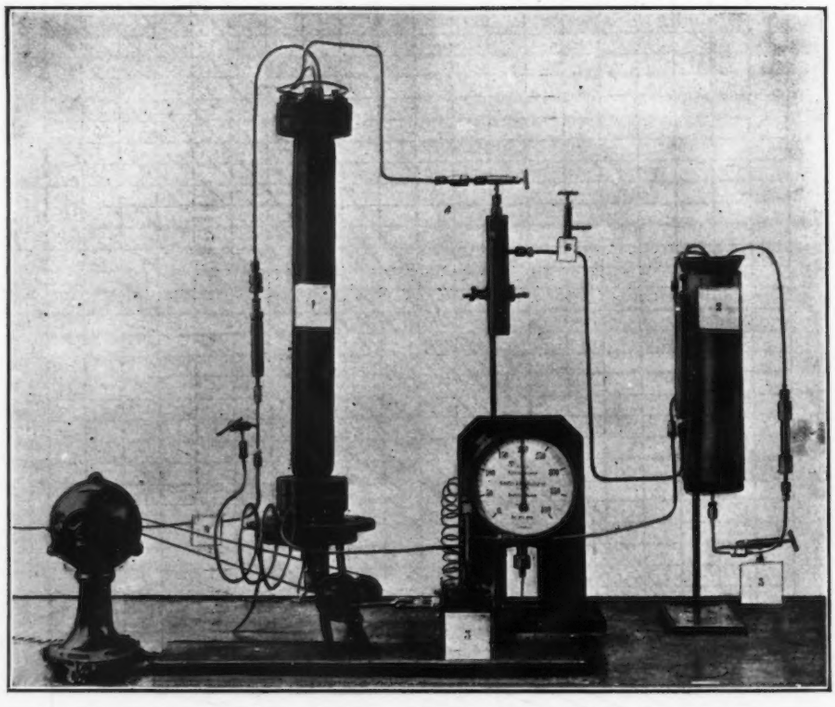
Efficiency of Various Catalyzers

Extensive experiments on the efficiency of various catalyzers at pressures close to 200 atmospheres has shown osmium to exert an excellent catalytic action. As osmium is very scarce, the experimenter sought another catalyzer more abundantly present in nature. Uranium was found to be quite suitable for this purpose.

Uranium reduced by an electrical arc from uranium oxide, is dissociated in a gaseous mixture at high pressures into a very fine powder, absorbing nitrogen, excellent catalytic action having been demonstrated at a temperature below 500 deg. Centigrade.

These results would seem to prove the commercial possibilities of the process. The amount of energy required for compression and for effecting the circulation of gases is low, and the heat and cold requirements are said to be of secondary importance, provided the temperature in the reaction vessel is chosen at a suitable figure.

The Badische Anilin und Soda Fabrik, at Ludwigshafen, is further developing the process so that the high-pressure systhesis of ammonia from its elements may be safely counted among the processes on which we can depend for yielding new sources of nitrogen products.



Apparatus for Synthetical Production of Ammonia

Reference numbers indicate: (1) Reaction chamber. (2) Liquefier. (3) High-pressure circulation pump. (4) Gas supply. (5) Ammonia discharge. (6) Testing cock.

Tin Ore in Canada

The discovery of tin ore near Arnprior, Ont., is reported by William M. Courtis, of Detroit, Mich. Two years ago a shaft was sunk on a calcite vein to prospect a galena deposit. What was supposed to be blende was found, and thrown over the dump as worthless. This waste material was recently tested and was found to contain 4½ to 10 per cent. tin as cassiterite and stannite. The deposit is said to cover a large area, and ample water power is available within one mile of the property.

According to the *Journ.* Soc. Chem. Ind., titaniferous iron ore is first smelted with carbon, and the reduced crude iron drawn off. The slag, rich in titanium, is converted into a reducing agent by strongly heating it with carbon, and is then mixed, at a temperature of about 2000 deg. C., with subsequent charges of ore, which are thereby reduced to silicious iron free from titanium, and a slag rich in titanium and poor in iron.

[1]"Equipment and Ore Handling at Cornwall Mine," Eng. and Min. Journ., Oct. 9, 1909.

[2]*Min. and Sci. Press*, Nov. 6, 1909.

*3 Regensburger strasse, Berlin, Germany.

Exploration of Contact Metamorphic Ore Deposits

Orebodies in Pure Limestone Are Irregular and Limited to Short Distance from Contact. Deposits in Argillaceous Limestone of Greater Importance

BY C. A. STEWART*

Several years ago Waldemar Lindgren described the character and genesis of certain ore deposits found in contact-metamorphic zones, produced by the intrusion of igneous rocks into sediments[1]. Since then further investigation has disclosed facts and evolved theories not considered in that paper. It is the purpose of this article to summarize such of these later views as may be of interest to engineers engaged in prospecting or exploring orebodies of this class.

Definition and General Characters

Contact-metamorphic deposits are orebodies resulting from the action of igneous rocks upon the sediments which they penetrate[2]. They occur most often in calcareous sediments near the contact with an acidic intrusive, and are distinguished most readily by their association with the contact-metamorphic silicates of which the most common are garnet, epidote, diopside, tremolite, actinolite and wollastonite. Many rarer minerals are found in subordinate amounts, among them vesuvianite, scapolite, fluorite and tourmaline, although the scarcity of these last minerals, supposedly characteristic of pneumatolysis is notable. The most common ore minerals are pyrite, chalcopyrite and magnetite; less often bornite, pyrrhotite, specularite, sphalerite and galena. Weed has called attention to tellurides, arseno-pyrite and bismuth minerals[3]. Most of the workable deposits of this class are copper or iron ores, but lead and zinc are not unknown, although of the two zinc seems the more abundant. The gold and silver are usually low.

Many contact metamorphic deposits have the irregular bunchy shape common to limestone replacements; in some cases, however, they may hold sharply to certain beds; and in rarer instances they cut the surrounding rocks in a manner resembling dikes. The connection between origin and shape will be discussed later.

Origin of the Gangue Minerals

It is a theory widely accepted among economic geologists that the metamorphic silicates forming the gangue of these deposits are the result of substances contributed to the limestone by the intrusive. The igneous rock is supposed to have given off highly heated water vapor holding in solution alumina, silica, iron and other elements which have combined with the calcium of the limestone to form garnet, epidote, etc. These same solutions, or others following closely upon them, also brought in the ore-forming minerals. The chief basis for attributing the silicates to the intrusive is the work of Kemp[4] and Lindgren[5] who have shown that certain contact zones are far richer in silica, alumina and iron than those portions of the same limestone which lie outside of the metamorphosed zone.

On the other hand, it has been maintained by many investigators, among them the petrographers Rosenbusch and and Harker, that most contact-metamorphic zones represent simply the recrystallization of silicious and aluminous material originally present in the sedimentary rock, and that the function of the igneous rock has been merely to furnish heat and water to promote this recrystallization.

In some cases this view is supported by analyses showing a close agreement in composition between the metamorphosed and unmetamorphosed sediment. Weed and Barrell[6] have described an instance at Elkhorn, Mont., where the intrusive, though producing no new minerals in the pure limestone beds, has developed garnet, augite and wollastonite in the more argillaceous layers, thus indicating a recrystallization of impurities rather than an addition of material from the igneous rock as the cause of the contact metamorphism. Similar conditions have been described from other localities, notably Camp Washington, Ariz., by Crosby[7].

Loss of Volume Due to Recrystallization

It is evident that recrystallization of an impure limestone to garnet, epidote, etc., involves the loss of CO_2 and the production of dense minerals, and therefore a great shrinkage in volume. Kemp has maintained that the lack of brecciation or other evidence of volume changes in a contact zone is an indication that there has been addition of material from the intrusive. Weed and Barrell, on the other hand, believe that such a shrinkage can take place without serious destruction of the original rock structures, and that this shrinkage may produce a porous, brick-like rock in which the ores are afterward deposited.

Interesting cases in which both recrystallization of impurities and addition of material from the magma have played a part in the metamorphism have been described by Barrell[8] at Marysville, Mont., and by Knopf[9] on the Seward Peninsula. In these places it has been possible to separate the results of the two processes, and to determine that the heat of the intrusive has produced a general recrystallization of the surrounding rocks. The heat has also developed typical contact minerals in the more argillaceous strata, followed by emanations from the igneous mass bringing in silica, alumina and other substances thus forming a second set of contact minerals.

Origin of the Ores

As noted above, contact-metamorphic deposits are frequently found in limestones of such high purity, that we are compelled to assume that the alumina, iron and silica in the garnet, epidote and other gangue minerals were brought in by solutions emanating from the igneous rock. In view of the intimate association of the ore with these contact minerals it seems most reasonable to believe that it also was introduced by the cooling intrusive. Weed makes these deposits in pure limestones a type distinct from those found in the more clayey rocks.

Orebodies of the first class are more irregular in shape and are limited to shorter distances from the contact than those of the second. They may be found at almost any place in the limestone horizon, although as will be shown below, lines of fissuring may have influenced their location. Some of the ores of the Clifton-Morenci district, Ariz., occur in nearly pure limestones, in which the sulphides and gangue minrals are contemporaneous.

Deposits in Argillaceous Limestone

The orbodies in argillaceous limestone[10] are of far greater economic importance than those in the pure limestone. These deposits differ from those of the first class in that there have been two distinct stages in their formation. The first step was a recrystallization of the clay beds of the sedimentary series into a

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[1]*Trans.* A. I. M. E., XXXI, pp. 226-224, 1901.

[2]*Trans.* A. I. M. E., XXXI, pp. 226-244 pp. 715-746.

[3]*Loc. cit.*

[4]*Econ. Geol.*, II, pp. 1-13; 1907.

[5]U. S. Geol. Surv., *Prof. Paper*, 43.

[6]U. S. Geol. Surv., *Twenty-second Ann. Rept.*, II, 419-510, 1901.

[7]*Trans.* A. I. M. E., XXXVI; 626-646, 1905.

[8]U. S. Geol. Surv. *Prof. Paper*, 57, 1907.

[9]U. S. Geol. Surv. *Bull.* 358, 1908.

[10]Weed, *Trans.* A. I. M. E., XXXIII; 746.

porous, brick-like mass of metamorphic silicates and sometimes calcite. The ore-bearing solutions permeated this rock, filling the pores and replacing the original minerals. These ore-bearing solutions may also bring in silica, alumina, etc., to form additional gangue minerals that can with difficulty be distinguished from the silicates resulting from recrystallization. Weed cites as examples of this type the Cananea, Mex., and Bannack, Mont., deposits. Ores of this class are to be looked for in the argillaceous sediments, particularly the clayey limestones. They are more nearly tabular in shape, hold more regularly to certain beds and may be found extending to greater distances from the intrusive than deposits of the first type. The best way to recognize this type of deposit is to follow ore-bearing beds along the strike until the unmetamorphosed equivalents are reached. If these prove to be more argillaceous than the continuation of barren sediments, it is most probable that porosity resulting from recrystallization has been an important factor in localizing the ore, and prospecting may best be carried on in the impurer limestones.

The information at hand on the paragenesis of the minerals of contact deposits gives an interesting confirmation of the views advanced above. In general terms we may say that most deposits show a series of silicates formed first. After these come the ore minerals, usually intergrown with a second series of silicates, and there is often a period of formation of contact minerals continuing after the ore deposition. The first silicates may be attributed to recrystallization; the second to magmatic solutions, and those following the ore either to a continuation of the silicious emanations after the metal bearing solutions have ceased, or to a recrystallization of the gangue minerals of the first two series.

Extent of Contact Effects

It has already been pointed out that orebodies originating by the replacement of a pure limestone are likely to be limited to short distances from the intrusive, while in the case of deposits that are due to impregnation of porous beds produced by recrystallization, the extent from the igneous rock may be greater. Actual measurements of the distance to which the contact effects extend show great variation, and the two kinds of metamorphism are not always separated. The following figures will give some idea of the range. Recrystallization is limited to 900 ft. at Bingham, Utah, and to 200 ft. on Seward Peninsula, Alaska, while at Tres Hermanas, New Mex., the contact zone is, in places, over 1000 ft. wide and some contact effects have been noted over a mile and a half from any outcrop of igneous rock.

At Marysville, Mont., emanations from the intrusive have penetrated the sediments 600 to 1000 ft., which is much less than at Morenci, Ariz., where certain contact ores are found over 2000 ft. from the intrusive. Vogt puts the distance to which the contact-metamorphic effects may extend at over a mile. It must be remembered, however, that most of these larger figures represent horizontal measurements from the nearest known igneous rock, and that actually there may be an offshoot of the intrusive concealed only a short distance from the metamorphosed area. As a general thing the best place to look for a contact deposit is close to the contact, but the possibility of the igneous rock bulging out in depth or sending out apophyses not seen at the surface must be borne in mind, for under such circumstances we may get ores in places, which, as far as can be ascertained from the surface geology, are not near the contact.

Factors Determining Location of Orebodies

One of the most noticeable features of contact-metamorphic deposits is the irregular way in which they are scattered in the sediments, at first glance seeming to follow no rules that would aid in finding them. That one class of these deposits does favor the more impure limestone beds has been pointed out, and it remains to be shown that the site of many contact deposits is determined by conditions of porosity or fissuring. At Morenci, the purer limestones are the favorable rocks, but of these the more porous are the best. In many districts fissuring has resulted from the intrusion of the igneous rock, and it is along these fissures that contact metamorphism and accompanying ore deposition have taken place most frequently. As instances, we may mention Bingham, Utah; Cochise, Ariz.; Marysville, Mont.; and Taylor Peak, Colo., where the ores, although typical replacements of the limestone and not vein filling, are associated with fractures which have served as conduits for the magmatic solutions. In some regions where the igneous rock is of considerable extent, it varies in composition from place to place, and in these cases the more acidic parts are most likely to have produced contact deposits. There are places where contact effects seem to be greatest near the dikes extending out from the main mass of the intrusive, but as the opposite holds true in other places, generalization on this point is unsafe.

Method of Formation of Deposits

It has usually been assumed that the solutions from the magma deposit their minerals by replacing the limestone wall rock or its recrystallized equivalent, and this view seems in accord with the field relations and microscopic structures of most deposits.

O. Stutzer has, however, advanced a theory which may account for some peculiar types of contact deposits.[11] According to him, the magmatic solutions may dissolve, bodily, parts of the limestone, thus making a solution containing both the ore, silica and alumina coming from the magma and the elements contained in the sediment. This solution eats its ways into the rock until saturation and cooling cause it to precipitate its minerals. In this way we get an intergrowth of calcium-aluminum silicates and ore, resembling in many of its features a pegmatite. The possible value of this theory seems to be an explanation of those peculiar deposits in which there is a mixture of contact-metamorphic silicates and ore which in their field relationships resemble dikes, pipes, or chimneylike bodies. As deposits to which this view might apply, we may mention the orebodies of White Knob,[12] Ida.; the Chillagoe copper region, Queensland,[13] and the Seven Devils district, Ida.[14]

Associated Deposits

It is a significant fact that a district containing contact-metamorphic ore deposits is likely to show deposits of other types either of the same or different metallic content. Many regions in which mining activity first started on the contact ores have afterward obtained their greatest production from vein or disseminated deposits. This has been particularly true of copper camps. The contact ore is usually copper and iron, with little or none of the precious metals, sometimes carrying minor amounts of sphalerite, but seldom showing appreciable quantities of lead. The veins in the same district apparently genetically associated with the same intrusive may be more complex, carrying in addition to copper, varying proportions of lead, zinc and the precious metals. A well known example of the differences in metallic content shown by ores in the same district is Bingham, Utah, where the contact metamorphic deposits are chiefly copper, with minor amounts of silver and gold, the veins are largely lead and silver, with subordinate gold, and the disseminated ore in the porphyry is copper. Such a variation cannot be considered to hold universally, for in many cases there is close similarity in the ore of contact and vein deposits.

Contact deposits are characteristically lean in their primary form, and are seldom valuable unless secondary enrichment has taken place. The finding of a nonworkable contact deposit, therefore, may justify prospecting the district for richer veins.

Summary

The points of greatest interest to the

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[11] *Zeit. f. Prak. Geol.*, XVII: 145-156, 1909.

[12] J. F. Kemp and C. G. Gunther, *Trans.* A. I. M. E., XXXVIII: 269-296, 1907.

[13] Geo. Smith, *Trans.* A. I. M. E., XXXIV; 467 *ff.*

[14] Wm. Beals, Jr., Eng. and Min. Journ., Vol. 69: 345-346, 1900.

engineer and prospector are as follows: Contact deposits should be looked for in calcareous rocks near acidic intrusives, but possible variations, in depth, of the shape of the igneous mass, must be considered when determining what strata are near the intrusive. In many cases the ore is to be expected in the clayey beds of limestone. Zones of fracturing are also important. Orebodies found in clayey beds are likely to be more tabular and extend farther from the intrusive. In rare cases intergrowths of ore and characteristic contact minerals may be found in the shape of dikes and veins. These will probably not extend far from the igneous rock or from the associated limestones which have furnished the calcium for the garnet, epidote, etc. Contact metamorphism may be but one phase of extensive mineralization of a district, and although these deposits in themselves may be lean, there may be richer veins or disseminated deposits in the vicinity.

Although contact deposits frequently accompany the igneous intrusions with which orebodies are associated, this is not always true, and there are many intrusives known to carry ore, that have produced little or no metamorphism in the sediments which they cut. The porphyry at Ely, Nev., carries a larger amount of disseminated copper, but it has produced very little effect upon the limestone which it intrudes.

Ayton's Thick Sand Extractor and Slime Separator

The Ayton thick sand and slime separator is used in preparing pulp for regrinding and for cyanide treatment. It is positive in its action and has a wide range of adjustment, which permits its use under widely varying conditions.

It consists of a conical tank made of sheet steel, having a central feed pipe and a top overflow. The bottom of the conical tank is fitted with a casting having a removable, cast-iron valve seat, provided with tool-steel removable bushings. Bolted to the bottom casting is a foot casting having two arms or brackets with bearings, which carry a short shaft. On this shaft is an 18-in. pulley, to receive power, and a wheel which has four rollers mounted on one side of the rim. These rollers actuate the valve lever so as to open the valve. The opening of the valve is intermittent and the frequency of its openings can be regulated by the number of rollers placed on the side of the wheel and the speed of the wheel. The conical tank is 5 ft. high.

Ayton's Separator at the Ananena Mill

One of these machines at the Ananena mill, Guanacevi, Durango, Mex., handles 350 tons of mill solution every 24 hours, containing 11 per cent. of ore; delivering 48 per cent. dry sand (12 mesh) to a tube mill and delivering slime (200 mesh) to the treatment tanks. An 8-ft. machine is used.

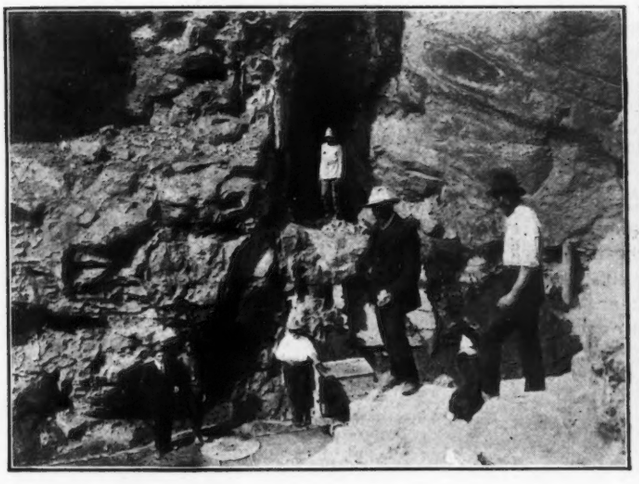
The working combination of the two machines is as follows: The 5-ft. machine takes out the sand by way of the bottom of the cone and delivers it to the tube mill, while the overflow, which carries off the slime and solution, is delivered to the 8-ft. cone of the second machine. The second machine takes out the slime by way of the bottom and delivers it to the treatment tanks, while the clear solution overflowing from the top is conducted to the clarifiers or zinc boxes.

The machines are easy to operate and require a small amount of power. They are manufactured by Chalmers & Williams, Commercial National Bank building, Chicago, Ill., under license from the patentee.

The Groenfontein Tin Mines

By E. M. Weston *

The tin deposits of the Groenfontein and the neighboring Zaaiplaats mine were recently described by me.[1] A yearly report of the company gives further interesting particulars. The output for 1909 was valued at £96,806, giving a profit of £58,394. The ore crushed amounted to 22,732 tons, producing 1228 long tons of tin concentrate. From No. 9 pipe, 1100 tons of tin concentrate, valued at £80,000, have been won at a mining cost of £3000. The workings are 650 ft. deep and the consulting engineer states that some pipes have been traced to their source, which appears to be a soft seam underlying the pegmatite vein, which I described as being the indicator and marker of the upper western limit of the tin-bearing zone.



Face of Tin-bearing Granite, Zaaiplaats Tin Mine

Ten-stamp Mill, Zaaiplaats Tin Mine

Prospecting Work

This soft vein carries profitable ore in places, and it will be prospected and developed with the hope of finding the tops or apexes of the tin-bearing pipes which lie on the dip of the pegmatite vein and beneath it. In connection with these most puzzling and interesting tin-ore occurrences, M. R. Recknagel has contributed an interesting and, in some respects, revolutionary paper, on the origin of tin-ore deposits, to the Geological Society of South Africa. I hope, in a future issue of the Journal to give a résumé of its contents.

On Groenfontein, an Elmore vacuum plant is being erected to treat ore heavily charged with arsenical iron pyrite. The accompanying illustrations show the Zaaiplaats mine and mill.

*Mining engineer, St. Mary's buildings, Johannesburg, Transvaal.

[1]Eng. and Min. Journ., March 12, 1910.

Dredging and Hydraulic Mining in Victoria, 1909

In Victoria the term, "dredge mining," is used to designate bucket dredging, hydraulic dredging, hydraulic sluicing using water from centrifugal pumps and jet-elevator operations. Hydraulic sluicing is the term applied to gravitation plants, in which giants using hydraulic water under high head are employed for washing alluvial deposits.

On Dec. 31, 1909, there were in force in Victoria 234 gold-dredging and hydraulic-mining leases, comprising a total of 21,493 acres; 111 plants were actually operated in 1909. From these it is estimated that 748,133 oz. of gold and 526 tons, 5 cwt., 1 qr. 19 lb. of tin were recovered during the year.

Greatest Returns from Dredging

Fifty bucket dredges operated in 1909 for an aggregate period of 2006 weeks, handling 14,927,269 cu.yd. of material that yielded 53,709 oz. of gold, or 1.7 grains (approximately 0.07c.) per cu.yd. The area worked was 582½ acres, and the quantity of gold saved per acre 92.4 oz. The best record for a single dredge was 1136.8 oz. of gold from 52 weeks of operation on 22 acres of ground; the ground dug averaged one grain of gold per cubic yard.

The average weekly return of gold per plant was 26.7 oz.; the number of men employed, 670; weekly expenses for wages, fuel and water averaged about $267 per plant, equivalent to about 14 oz. of gold. Only one dredge is recorded as treating over 14,000 cu.yd. of material per week, and five others over 10,000 cu.yd. weekly.

The returns from dredging operations in Victoria during 1909 show a decrease of 1449 oz. of gold from the production of the previous year, and a decrease in dividends paid amounting to $54,864. Twenty-five companies paid dividends, ranging from $1215 to $26,535. The ground dredged yielded from 1 to 3.8 grains of gold per cubic yard of material treated. The total paid by the dredgers for wages, fuel and maintenance during 1909 was $694,673, and in dividends $233,085. The initial cost of the dredge plants was $1,209,382 and in a number of cases they have been paid for from the returns from their operations.

Pump Sluicing Operations Extensive

Fifty-two hydraulic-sluicing plants supplied with water from pumps operated in Victoria in 1909. These plants were operated for an aggregate working time of 965 weeks, during which 4,645,926 cu.yd. of material, returning 31,938 oz. of gold (3.3 grains per cubic yard) and 33 tons, 15 cwt. of tin, valued at $12,961, were washed. The area of the ground worked was 141½ acres; thus making a return of 225.7 oz. per acre. One plant yielded 3688 oz. of gold from 5½ acres of ground, containing 319,440 cu.yd. of material, or an average of 5½ grains per cubic yard. The average weekly yield of gold per plant was 33 oz.; the number of men employed, 1120; the average weekly cost for wages, fuel, water and repairs per plant, $437, equivalent to about 22½ oz. of gold. One plant washed over 16,000 cu.yd. of material per week and a number of others treated over 8000 cu.yd. The total production of gold for the year from this type of mining decreased by 15,727 oz. from the figure for 1908; dividends paid showed a decrease of $1807 and ranged from $1010 to $7290 per company. The ground worked averaged from 2.3 to 4.6 grains of gold per cubic yard of overburden and alluvial gravel treated. A total of $601,852 was paid by these plants for wages, fuel, water and maintenance, and $20,232 in dividends. The initial cost of the hydraulic-sluicing plants was $857,177.

Nine Jet Elevators Operated

In 1909, nine hydraulic jet elevators worked for an aggregate period of 145 weeks, treating 397,900 cu.yd. of dirt for a return of 2692 oz. of gold, or 3.3 grains per cubic yard of material treated. The area of ground worked was 13¾ acres; the quantity of gold won per acre, 196.5 oz. These plants employed 77 men. They represent a first cost of $41,372.

Little Gravitation Sluicing Done

Ten hydraulic-mining plants operated in Victoria in 1909 for an aggregate period of 110 weeks. The quantity of material treated was 201,887 cu.yd., from which a return of 630 oz., or an average of 1.5 grains per cubic yard of material treated was realized. The area worked was 7⅔ acres; the gold saving per acre thus being 82 oz. The highest yield was 125 oz. Besides the gold, 36 tons, 11 cwt. of tin, valued at $11,858, were recovered in the hydraulic mines.

Yield and Dividends for Each District

The accompanying table shows the respective mining districts, the number of plants operated in each, the yield of gold and the dividends paid during 1909 from placer-mining operations; this includes only the operation of dredges, jet elevators and pump sluices. The figures are necessarily approximate, owing to the nature of the returns from some of the privately owned plants.

Development in Dredge Construction and Operation

An interesting development in dredge construction has been the building of a dredge to strip off top soil and earthy overburden, depositing it on top of the washed débris and tailings from the sluice boxes.

The Briseis company's No. 2 Red Bluff dredge is the first gold-mining dredge constructed in Victoria, on which an effective appliance to deal with the overburden has been successfully tried. In brief, the plant is an ordinary bucket dredge with sluice boxes and belt conveyer. The buckets are reported to be of 4-cu.ft. capacity and to be operated at a speed of 12½ buckets per minute. The material from the buckets may, by means of a drop chute, be diverted into either the sluice boxes or to the conveyer. When overburden is being dealt with the material from the drop chute passes on to a shaking table, operated by springs and eccentric rods, thence on a belt conveyer that may be adjusted to any desired angle and dumped clear of the stern of the dredge on top of the gravel, etc., previously run through the sluice boxes. The conveying belt is 125 ft. long, 2 ft. wide, ½ to ⅝ in. thick, and is run at a speed of 160 ft. per minute.

RETURNS FROM DREDGE MINING IN VICTORIA.

Mining District.	No. of Plants.	Gold Won During 1909, Oz.	Dividends Paid During 1909.
Ararat and Stawell	...	...	.....
Ballarat	11	11,258	$ 4,680
Beechworth	52	54,294	213,645
Bendigo	3	461	.....
Castlemaine	25	12,508	25,393
Gippsland	8	4,591	12,757
Maryborough	12	5,227	.....
Total	111	88,339	$256,475

This dredge was, when observed, operating on a bank of overburden that extended to a depth of 8 ft. below water level and from 3 to 6 ft. above it. The depth of soil deposited behind the dredge on the gravel and tailings ranged from 3 to 6 ft. Probably one-third of the alluvium was conveyed by the belt and dumped in a dry state, one-third fell through the well hole into the operating pond, and one-third was scooped up with the auriferous gravel by the buckets and, after passing through the sluice boxes, discharged as sludgy water at the stern of the dredge. It is thought that, when such improvements as will provide for the full discharge of the solid contents of the buckets into the drop chutes are perfected, probably two-thirds of the overburden treated will be transferred from the working face directly to the tailings dump astern of the dredge.

NOTE—Abstract of an article by D. B. Sellers, government engineer-in-charge, *Aust. Min. Stand.*, June 22, 1910.

Rapid Electrolytic Determination of Copper

BY R. C. BENNER*

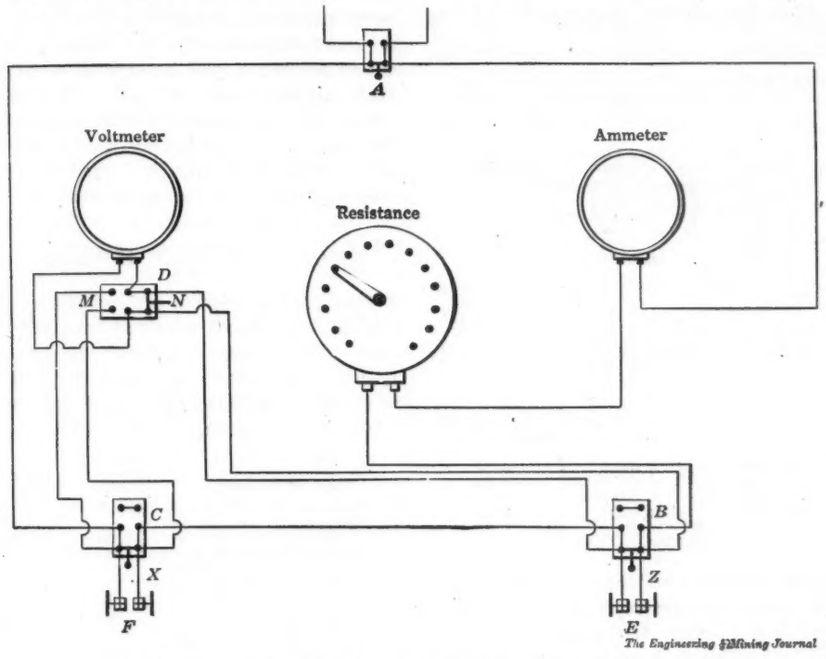
The determination of copper in ore and furnace products can be made more accurately by the electrolytic than by any of the other methods. But it is too slow. The most rapid determinations in technical work with stationary electrodes take from three to five hours when the Guess-Haultain method is used. Recently the rotating electrode has been utilized for the determination of copper. This apparatus, while an improvement on all others, so far as rapidity of operation is concerned, and as accurate as the older methods, possesses the disadvantage of being complicated, when all of the attachments necessary for the successful operation on a large scale are considered.

Frary[1] has been able to do away with the motor, rotating the electrolyte by means of a solenoid and using a gauze cathode on which the deposition of the metal is made. Stoddart[2] has made a few experiments which seem to show that Frary missed the best part of his own work and that the precipitation of some metals, including copper, can be made nearly as rapidly with the gauze electrode alone, as when combined with the solenoid.

With the experiments of Stoddart in mind, a platinum wire-gauze electrode of 52 mesh, corrugated and sand-blasted, was designed for the determination of copper in ore. It is about 1 in. in diameter by 1½ in. long. With the simple apparatus shown in the accompanying illustration, it is possible for one man using this electrode to make from six to eight determinations in an hour.

Arrangement of the Electrode

The illustration represents a plan of the deposition system. The current enters the system at the switch *A*, passing through the ammeter and resistance coil to the switch *B*, by means of which it is possible to either throw the current through the electrolytic cell *E*, when the switch is down, or when it is up, to make a short circuit around the cell. By means of a similar switch *C*, a second cell *F* may be put in series with *E*, or by means of the short circuit in *B* may be operated alone. Thus either cell may be operated alone or in series with the other. The voltmeter is connected by means of a double-throw, double-pole switch *D*, so that it is possible to leave the voltmeter disconnected when the switch is out; when it is in on the right hand side, the reading gives the voltage across the poles of cell *E*; when in on the left-hand side, it gives the voltage across the poles of the cell *F*. The danger of contaminating the determination from the binding post is avoided by making them of aluminum. This is likely to occur when such high currents are used, as frequently the liquid becomes heated to the boiling temperature before the determination is completed, with the result that the HNO_3 fumes corrode the binding posts.



Apparatus for the Rapid Determination of Copper

Cost of the Apparatus

A current of at least 15 amp. and 10 volts is required. I obtain this current at 10 volts pressure by using a small motor-generator driven by an alternating current, which in spite of variations of several amperes during the determination, is satisfactory. A rectifier, although not as satisfactory as a motor-generator, has a much smaller first cost and does the work in a very satisfactory manner. A rotary converter will cost from $100 to $120, while a rectifier can be obtained for about $15. If there is direct current at hand, neither of the pieces of apparatus mentioned is needed, as a rheostat will answer.

TABLE I. RESULTS WITH PURE COPPER FOIL.

Cu Taken.	Cu Found.	Vol. of Solution.	Amperes.	Volts.	Time, Min.
Grams.	Grams.	C. C.			
0.1181	0.1181	75	10 to 15	8	10
0.3586	0.3586	75	10	3 to 4	12
0.2330	0.2332	75	8 to 10	3 to 4	12
0.2142	0.2142	75	8 to 10	4	15
0.2374	0.2375	75	8 to 10	4	15

The ammeter and voltmeter used are neither expensive nor cumbersome. Instruments 3 or 4 in. in diameter, having the required range, cost from $10 to $15 and are sufficiently accurate.

The resistance box necessary will depend upon the current, so that it is hard to give any price for this; but, at the most, a satisfactory box should not cost more than $15. The gauze electrodes weighing from 6 to 10 grams will cost between $12 and $17 each. It is necessary to have four of these in order to get the best results, as this enables the chemist to keep employed with the work. Two of the other electrodes are sufficient, as no depositions are made on them, and they can be used continuously. Taking all of this into consideration, the complete apparatus will cost between $100 and $125, but may be reduced if the chemist is willing to use lighter electrodes.

TABLE II. RATE OF DEPOSITION.

Time, Min.	Copper Deposited, Grams.	Time, Min.	Copper Deposited, Grams.
1	0.0625	6	0.2039
2	0.1129	7	0.2100
3	0.1518	10	0.2205
4	0.1706	12	0.2206
5	0.1901	..	.....

*Department of chemistry, University of Arizona, Tucson, Ariz.

[1]*Zeit. f. Elektrochem.*, No. 23, 358.

[2]*Chem. News*, Vol. 69, 293.

Accurate Results Obtained

In testing the accuracy of the method, pure copper foil was used. This was dissolved in 3 c.c. of HNO_3, diluted to 75 c.c. and electrolyzed at about 10 amp. and 4 volts. The results shown in Table I demonstrate the accuracy of the method.

TABLE III. COPPER IN THE PRESENCE OF ARSENIC.

Arsenic Taken, Grams.	Copper Taken, Grams.	Copper Found, Grams.
0.0605	0.2652	0.2648
0.1210	0.2751	0.2747
0.1815	0.2183	0.2183
0.1210	0.3038	0.3035
0.2420	0.2686	0.3106
.....	0.2028	0.2026

The copper deposited under these conditions is firm and adherent, in every way equal to the deposits obtained by the other methods when the conditions are at their best. With this procedure, the amount of copper it is necessary to weigh for technical assays will be deposited in from 10 to 15 minutes.

Table II shows the rate of deposition.

In each of these determinations, 0.2203 grams of copper were taken and electrolyzed with a current of 10 amp. and 3 to 4 volts in 75 c.c. of solution containing 3 c.c. of concentrated HNO_3.

Behavior of Interfering Elements

Of the elements likely to occur in copper ore, which interfere in the ordinary

TABLE IV. RESULTS ON ORE USING GAUZE ELECTRODE.

Copper Ore Taken, Grams.	Copper Found, Grams.	Per Cent. Copper Found.
0.5003	0.0825	16.49
0.5003	0.0824	16.47
0.5003	0.0770	15.39
0.5003	0.0769	15.37

TABLE IV A. RESULTS ON ORE BY THE ORDINARY METHOD.

Copper Ore Taken, Grams.	Copper Found, Grams.	Per Cent. of Copper Found.
0.5000	0.0825	16.50
0.5000	0.0825	16.50
0.5000	0.0770	15.40
0.5000	0.0769	15.38

electrolytic method under the conditions used in these determinations, are Sb, Ag, As, Pb and Bi. The separation of antimony and bismuth from copper was tried by this method without success. The separation of arsenic is satisfactory when small amounts are present; with large amounts, part of the arsenic is thrown down before the precipitation of the copper is complete. In order to make a separation it is necessary to deposit all of the copper and part of the arsenic, then dissolve in HNO_3 and reprecipitate, when, owing to the small amount of arsenic present, the copper will be precipitated free from arsenic.

Table III shows the results of determinations of copper in the presence of gradually increasing amounts of arsenic under the conditions used in the determination of copper and illustrates the statement made above. All of these depositions were made in 75 c.c. of solution and in the presence of 3 c.c. of HNO_3 with a current of 8 to 10 amp. and 4 to 7 volts.

Process for Ores

An ore which contains none of the interfering elements is dissolved in HNO_3 or HNO_3 and HCl. When *aqua regia* is used, H_2SO_4 is added and the solution evaporated until fumes of SO_3 are evolved. The excess of acid is then neutralized with NH_4OH and 3 c.c. of HNO_3 added, the solution diluted to 75 c.c. and

TABLE V. RESULTS ON SLAGS BY THE GAUZE ELECTRODE.

Ore Taken, Grams.	Copper Found, Grams.	Per Cent. of Copper Found.
1.0000	0.0060	0.60
1.0000	0.0059	0.59
2.0000	0.0123	0.61
2.0000	0.0103	0.51
2.0000	0.0101	0.50

TABLE V A. RESULTS ON SLAGS BY THE ORDINARY METHOD.

Ore Taken, Grams.	Copper Found, Grams.	Per Cent. of Copper Found.
2.0000	0.0121	0.60
2.0000	0.0121	0.60
1.0000	0.0051	0.51
1.0000	0.0050	0.50

transferred to a tall battery beaker without filtering and electrolyzed at 10 amp. and 3 to 4 volts. If the deposit is black or dark colored, it is dissolved in HNO_3 and redeposited. Table IV shows the success atending the use of this method on ores.

Process for Slags

In case of slags and other low-grade material it is especially necessary to select a method of disintegration suited to the substance at hand. In the case of slag, the best results can frequently be obtained by treating with HNO_3 and then evaporating with HFl and H_2SO_4 to remove the large amount of silica. After evaporating to fumes, the ore is diluted sufficiently to put everything in solution and electrolyzed in the usual manner. The deposit may come down black when there is a large amount of foreign matter present, especially iron. In this case it is dissolved and reprecipitated under the usual conditions with excellent results, as shown in Table V.

Removal of the Interfering Elements

The removal of the interfering elements can be accomplished by chemical means in the following manner. Disintegrate the ore with HNO_3 and HCl, add 5 c.c. of H_2SO_4 and evaporate until heavy white fumes of SO_3 are evolved. Now dilute to 150 c.c. with water, boil to insure complete solution of the basic iron sulphate (add a few drops of HCl if silver is present) filter and wash with water containing a little H_2SO_4. The Pb and Ag will remain on the filter paper. The filtrate is now heated to boiling and saturated with H_2S, allowing the solution to cool during the process.

The precipitated CuS is filtered off and washed with water containing H_2S. Rinse the precipitated sulphides from the filter paper into a beaker, using as little water as possible; warm with a little colorless Na_2S to remove the As and Sb, and again pass through the same filter; wash with water containing a little Na S. Bi is then removed from the Cu by warming the mixed sulphides with a solution of KCN made alkaline with NH_4OH. This dissolves the Cu, leaving the Bi insoluble. The solution containing the Cu is boiled with HNO_3 to destroy the cyanide and then electrolyzed in the usual manner.

Products of Crude Petroleum

There are at present nine products, or classes of products, obtained from petroleum. The names of these are given (*Journ.* Soc. Chem. Ind., July 30, 1910) in the accompanying tabulation, together

PRODUCTS OF CRUDE PETROLEUM

	Kind of Product.	Per Cent. Yield.	Amount, Bbl.
1.	Kerosene	20.50	15,000,000
2.	Lubricating oils of all kinds including greases	10.00	7,000,000
3.	Napthas, all grades	15.00	11,250,000
4.	Gas oil, used for enriching water gas in large cities	30.00	22,000,000
5.	Paraffin wax	1.50	1,125,000
6.	Roofing pitch	2.50	1,875,000
7.	Paving pitch and road-making oils	2.00	1 500,000 Tons.
8.	Coke	3.00	300,000 Bbl.
9.	Fuel oil	14.00	1,050,000
		98.50	
	Loss in manufacturing	1.50	
	Total	100.00	

with the yield of each class in percentages and the total production in the United States for 1909, stated in barrels.

The Goshen Iron Company, of Wilmington, Del., has purchased the Victoria blast furnace, which it has been operating at Goshen, Va., since 1907, under lease from the Chapman Iron, Coal and Coke Company, Inc. The Victoria stack has an annual capacity of 18,000 net tons of pig iron. The purchase also includes Virginia iron ore and coal lands and some West Virginia coking coal properties at Elverton, W. Va. It has been operating 60 coke ovens.

Coal Mining Fatalities in Belgium

Explosives Are Prohibited in All Fiery Mines. The Great Care Observed in Timbering, Ventilating and Hoisting Results in Low Death Rate

BY FREDERICK L. HOFFMAN*

The fatality rate in Belgian coal mines is frequently quoted as conclusive evidence that mines intrinsically dangerous can be operated with comparative safety. The Belgian coal formation includes a large number of seams of a thickness of from about 1 to 6½ ft. Seams exceeding 3¼ ft. in thickness, however, are rare, and the average thickness of the seams worked is only about 2.13 ft. Most of the rich seams have been completely exhausted, and increasing difficulty is experienced in working the thin seams, with a due regard to profitable results.

The course of the seams in the central part of the Belgian coalfield is very crooked and said to be "alternating in zigzag, horizontal and vertical layers." The coal belt is divided into five districts of variable conditions in their relation to safety in mining and the liability to fatal and serious accidents. A very interesting descriptive account of Belgian coal mines and mining methods was published in behalf of the Belgian Government in connection with the Louisiana Purchase Exposition in 1904, including a comprehensive statistical account of production, employees, and accidents for a long period of years. It is stated in the report that "the coal industry is carried on in Belgium under many difficulties, and it is only at the cost of unceasing endeavors both on technical and commercial ground, that it succeeds in maintaining its relatively flourishing position."

Method of Working the Mines

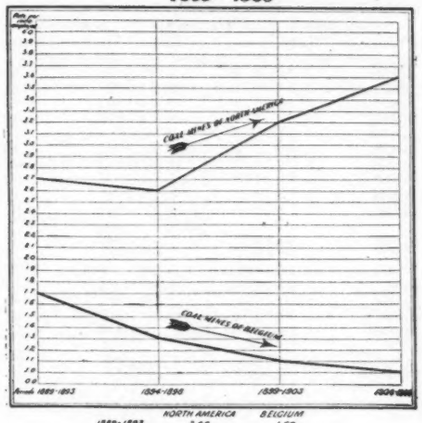
As to the method of working the mines, it is said that there are always at least two shafts, the one used as a downcast and the other as an upcast. In the more important mines, both shafts are used as winding shafts, and in the concessions worked by several pits, diagonal ventilation is often resorted to. Main crosscuts start from the shafts, the vertical distance between the landings being from 50 to 80 m. The working is carried out as a rule simultaneously in several seams, and on both sides of the main cross-cut; by this method each seam is provided with a separate air-current always circulating in an ascending direction, this scheme of ventilation being necessary owing to the large amount of firedamp contained in these deposits.

In continuation of this account it is stated that: "The only method of working generally used is that of continuous headings with complete gobbing which are pushed forward from the shaft toward the limits of the field. The pillar-and-stall system have occasionally been applied in some thick seams in the districts of the Centre and of Liege. The steeply inclined seams are worked in reverse steps, the flat seams either by rising or forward stalls. The disposition of the face in descending steps is followed in certain mines which are subject to sudden outbursts of firedamp.

Hand Mining Is Employed

"Coal cutting is nearly always performed by hand; it is preceded by holeing in the unproductive beds of the seam, which is skillfully accomplished by the Belgian hewer. Blasting in coal is restricted to

COMPARATIVE FATALITY RATE IN COAL MINING IN BELGIUM AND NORTH AMERICA 1889 ~ 1908



	NORTH AMERICA	BELGIUM
1889-1893	2.96	1.66
1894-1898	3.57	1.30
1899-1903	3.63	1.08
1904-1908	3.93	0.98

mines containing little or no firedamp; it is especially used in the hard seams of close burning coal of Charleroy. The consumption of explosives for the getting of coal in these seams varies from 20 to 48 kilograms per 100 tons. In the mines where the use of explosives is allowed the average consumption of explosives does not exceed 14 kg. per 100 tons.

"Compressed air is specially applied to drilling machines, drums and small fans. Haulage is mostly done by horses; mechanical conveyance is reserved to the main roads and is less developed than in other coalfields where the output is greater and more concentrated. Locomotives are preferred in Belgium to the endless rope or chain systems. Steam is only employed inside the mines for the pumping engines; the boilers are always placed on the surface. Electricity tends to replace other modes of transmission of power. In most cases continuous currents, with moderate voltage, are resorted to." These precautionary measures are necessary on account of the thinness and the contortion of the seams, the presence of firedamp, and the great depth of the mines. According to a report made to the U. S. Bureau of Labor in 1905, the average depths at which coal mining operations are carried on in Belgium vary from 1558 ft. in the Hainaut district to 1027 ft. in the Namur district.

The Timber Expense Is Considerable

Because of the thinness of the seams, coal cutting by machinery is practically impossible. A large amount of preparatory and unproductive work is necessary, as the result of which the proportion of miscellaneous labor is greater in Belgian mines than in those of other leading coal-producing countries. The rocks enclosing the coal, as stated in the official report previously referred to, are said to "exercise, as a rule, somewhat strong pressures and require solid propping." This accounts for the relatively large expenditure for timber, which amounts to about 20c. per ton of coal raised in the Belgian mines.

With special reference to the presence of firedamp, however, it is pointed out that: "The difficulties are still increased as most of the seams contain firedamp and large quantities of coal dust, and consequently, on one hand, large galleries have to be opened in order to secure a powerful ventilation of the workings, and, on the other hand, we are compelled to suppress the use of explosives which constitutes, as is well known, the most fearful cause of inflammation of firedamp. The police regulations of mines are particularly strict in this respect: they prohibit the use of explosives in all fiery mines for the getting of coal and for the cutting of the return airways; and in all fiery mines of the more dangerous class explosives are prohibited for the ripping of rocks in all ways which are not supplied with a strong current of fresh air coming directly from the downcast shaft."

Explosives Entirely Prohibited

In the coal seams known to be subject to sudden outbursts of firedamp, the use of explosives is entirely prohibited. The methods of mining in such seams are,

*Statistician, the Prudential Insurance Company, Newark, N. J.

therefore, entirely mechanical. The methods of production are, of course, slower and in some cases more expensive than if the use of explosives were permitted. The following extract emphasizes the control exercised over the use of explosives, with a resulting reduction in the liability to serious accidents:

"In the case of hard rocks, to avoid the dangers of inflammation of firedamp, safety explosives are employed. The progress accomplished in this direction has been notable within the last few years. The statistics drawn up by the office of accidents in mines and of firedamp, show that the quantity of explosives consumed for all uses in the coal mines amounted to 51 kg., in 1893, per 1000 tons of coal raised; out of these, 40 consisted of blasting powder, 6 of dynamite, and 5 of safety explosives; in 1901, the total consumption was 48 kg., out of which only 20 consisted of blasting powder, 17 of dynamite and 11 of safety explosives. The decrease of the total consumption and especially of blasting powder and other dangerous explosives has only taken place in fiery mines. In nonfiery mines 84 kg. of explosives are consumed per 1000 tons, whereof 73 consist of slow burning powders; in the most dangerous firedamp mines, 18 kg. of explosives are consumed, of which two-thirds are safety explosives."

Preventing Outbursts of Firedamp

It is observed, however, in this connection, that increase of security in firedamp mines is acquired at the expense of economy. The Government testing station, which was established by the Administration of Mines at Frameries, has achieved commendable results, which have caused the establishment of corresponding testing stations in other countries, including the United States. There can be no question of doubt but that fatalities due to gas and dust explosions have been reduced as the result of the efficient labors of the Belgian testing station under the administration of M. Victor Watteyne. Among the rules insisted upon in fiery mines is the one on shot firing by electricity, but the same process is extensively used in other mines, which are not subject to gas explosions. Aside from the scientific attention which has been given to the question of preventing accidents from gas or dust explosion, special regard has been had to ventilation to make the mines more healthful by supplying a sufficient volume of air. The chief consideration, however, has been the effort to prevent the sudden outbursts of firedamp, and the measures which have given the best results consist in limiting the daily advance of the wall-faces and in keeping bore holes in advance. As the result of this effort the fatal accidents due to sudden outbursts of firedamp are only one-third of the total number of such outbursts reported by the Administration of Mines. Of late years, portable electric lamps have been introduced, and apparently with satisfactory results. Regardless of the increasing difficulties in mining due to the conditions referred to, the fatality rate has rapidly diminished.

The Fatal Accident Rate

The fatal accident rate in Belgian coal mines has never been as high as in American coal mines during recent year, but the following figures are exceedingly significant. Between 1861 and 1870 the rate was 2.61 per 1000, diminishing to 2.45 during 1871-80, to 1.99 during 1881-90, and further to 1.39 during 1891-1900. During the last eight years the accident rate per 1000 men employed has been 1.17 in 1901, 1.07 in 1902, 1.13 in 1903, 0.93 in 1904, 0.91 in 1905, 0.95 in 1906, 1.04 in 1907, and 1.07 in 1908. The rate in detail for each of the years forming the period 1850-1908 is given in table No. 1, furnished by the Royal Administration of Mines.

TABLE 1. FATAL ACCIDENTS IN BELGIAN COAL MINES, 1850-1908.

(Rates per 1000 employed)

1850–1869. Year.	Rate.	1870–1889. Year.	Rate.	1890–1908. Year.	Rate.
1850	4.42	1870	2.25	1890	1.56
1851	2.61	1871	2.71	1891	1.40
1852	5.17	1872	3.17	1892	2.84
1853	2.86	1873	2.52	1893	1.12
1854	3.91	1874	2.30	1894	1.73
1855	3.55	1875	3.27	1895	1.40
1856	3.29	1876	1.82	1896	1.16
1857	2.71	1877	1.59	1897	1.03
1858	3.02	1878	2.08	1898	1.40
1859	2.81	1879	3.27	1899	0.97
1860	2.80	1880	2.73	1900	1.05
1861	2.56	1881	3.03	1901	1.16
1862	3.26	1882	2.09	1902	1.07
1863	2.89	1883	2.44	1903	1.13
1864	2.76	1884	2.26	1904	0.93
1865	3.53	1885	1.82	1905	0.91
1866	2.54	1886	1.33	1906	0.95
1867	2.53	1887	2.84	1907	1.04
1868	3.22	1888	1.75	1908	1.07
1869	2.71	1889	1.36		

The decline in the fatality rate has extended to all of the principal causes, and considering only the four decades forming the 40-year period 1861-1900, the decline has been as follows: Falls of coal and roof caused a fatality rate of 8.98 per 10,000 employed during 1861-70, the rate declining to 7.08 during 1871-80, to 6.61 during 1881-90, and to 5.10 during 1891-1900. The fatality rate due to firedamp declined from 3.44 during 1861-70, to 4.87 during 1871-80, to 3.64 during 1881-90, and to 2.55 during 1891-1900. Shaft accidents decreased from a fatality rate of 6.76 during 1861-70 to 5.56 during 1871-80, to 2.87 during 1881-90, and to 2.14 during 1891-1900. Miscellaneous accidents remained practically stationary during the first 30 years of the period, but the rate diminished from 6.87 during 1861-70 to 6.80 during 1881-90, to 4.12 during 1891-1900. There was a slight rise in the rate between 1871 and 1880, when it was 6.99. The decrease in the rate has continued, and during 1902 the rates were lower for the separate causes, or respectively, 4.30 for falls of coal and roof, 0.90 for firedamp, 1.71 for shaft accidents, and 3.76 for miscellaneous accidents.

How Increased Safety Was Obtained

In commenting upon the decline in the fatality rate, the government report previously referred to states that: "This constant improvement is the result of the combined efforts of the mine owners, the workmen, and the Administration of Mines; it is due to a great extent to diffusion of technical and professional education, to the keeping in force of the police regulations of 1884, and to the administrative organization of the scientific study of accidents."

The decline in the Belgian fatality rate during the last 40 years is in striking contrast to the material increase in the corresponding rate for the coalfields of North America. The table which follows shows the comparative fatality rate in coal mining in Belgium and North America in the 20 years ending with 1908.

COMPARATIVE FATALITY RATE IN COAL MINING, BELGIUM AND NORTH AMERICA, 1889-1908.

(Rates per 1000 employed)

	Belgium.	North America.
1889–1893	1.66	2.66
1894–1898	1.30	2.57
1899–1903	1.08	3.23
1904–1908	0.98	3.63

According to this comparison, the fatality rate for Belgium has diminished from 1.66 per 1000 to 0.98 during the last 20 years, while the corresponding rate for the North American coalfields has increased from 2.66 to 3.63. While the Belgian rate has decreased 0.68 per 1000 during the period under consideration, the rate for the North American coalfields has increased 0.97 per 1000. The contrast is an indictment of present methods of coal mining in the United States and Canada and the waste in human life is as appalling as, by Belgian standards, it is needless.

Withdrawal of Utah Land

By order of Secretary Ballinger, 51,780 acres of public lands in Tooele, Garfield and Kane counties, Utah, will become subject to settlement after Aug. 22. The lands were under temporary withdrawal for forestry purposes near Powell, Sevier and Nebo Forests, Utah, and are for the most part surveyed and unappropriated. Certain lands in San Juan county will also be restored to entry under the Enlarged Homestead act.

Systematic Development in Pittsburg Seam

The Main Feature Recognized Is the Pitch of the Basins, while the Serious Problem Encountered Is the Proper Control of Roof Settlement

BY F. Z. SCHELLENBERG*

Systematic exploitation in the Pittsburg coal seam on a large scale is simple where the boundaries of the property do not interfere by forcing drainage, ventilation and transport lines of entries to be run to particular confined fronts. A prime condition governing development is the natural direction of the seam's perpendicular cleavage planes, giving long lines of smooth faces near together and parallel, bearing about 65 deg. to the left of the meridian and therefore crossing the basins. The gradients of dip into the basins change from 10 per cent. at the east rim to practical flatness northwestward across the great coalfields, a hundred miles wide; the dip being halved in the rate at each successive crossing-over of an anticlinal crest. Elevations above sea level on this transverse section, in scope of present development, differ by 1000 ft. between low trough and high outcrop. Local irregularities of dip are found, but the main feature to be recognized is the pitch of the basins — the general rise northwestward at 20 ft. per mile, from 100 ft. below sea level at the low point near the southwest corner of Pennsylvania to 1500 ft. and more above tide, and the appearance then, at the surface, of the lower coal seams carried in the next deeper-lying thousand feet of rock measures; below which series come the oil and gas sands of Oliphant's charted column of strata, reaching down altogether 3000 ft. below the Pittsburg coal seam.

Because of the general regularity of occurrence of the coal seam, the mine map depicting the courses of economic operation to be undertaken and the steps in controlled exhaustion need be but a projection of two dimensions on the horizontal plane of space, and this for the most part composed of natural, almost unbroken lines, on the face and on the end of the coal, coördinating rectangularly.

Gas and Coking Coal Characteristics

The thin-vein gas coal of the Pittsburg region is bright, cuboidal, and hard, and is marked by having the mineral matter mostly in bedding slates defining the measures, while the coking soft coal of tall cross section at Connellsville is columnar-fissured to incoherence, and has its mineral matter less segregated. Intermediate in characteristic appearance and position is the thick coal of the transition territory.

Top and Bottom Coal Left In

The bedding layers, the main measures of the seam, which provide the greater part of the product, are very uniform in a district, the extremes of gradual variation in size being from 9 ft. total thickness at the east near Connellsville to barely 4 ft. 6 in. at the west beyond Pittsburg. In the eastern basin, 5 in. of main coal at the top and 2 in. at the bottom are left standing to cover the fire-clays above and below the bed and protect them from air-slacking. In the western region several inches of slaty bottom coal are left standing; then the 1-ft. fire-clay "draw slate" is regularly taken down as a hanging clod, in order to secure a safe, smooth, and higher top under the roof coal, which is of slaty layers and not to be removed unless ripped in grading entry over "swamp" in the seam's lay. Normal to the cleavage planes, on the face of the coal, is the direction of attack easiest to get product in quantity, and so in flat districts the rooms are always run for depths of 75 yd. The last detail of survey is the setting in the roof of "sights." These are points for ranging the room driving on parallel lines, with the dividing pillars, the room ribs, of even thickness.

The technical "mining" requisite for proper preparatory work at the face of advancing workings is to cut loose, by channel trenching, by hand or power pick, the bottom and one side at least, before rending violently the body of the coal to the same depth from the face. Formerly, in the gas coal, its peculiar band-slates were removed in making along them, instead of at the bottom, the undercutting channel called the "bearing-in"; and the vertical kerfing at the side called the "shearing" also always was made for getting lump coal by wedge and sledge instead of the "all-digging" that answered for soft coal. It is now attempted to partly or completely supersede undercutting and shearing by heavy charge blasting; but experience in every locality will repeatedly call for better select "lump," hard coal product, with less dangerous shooting.

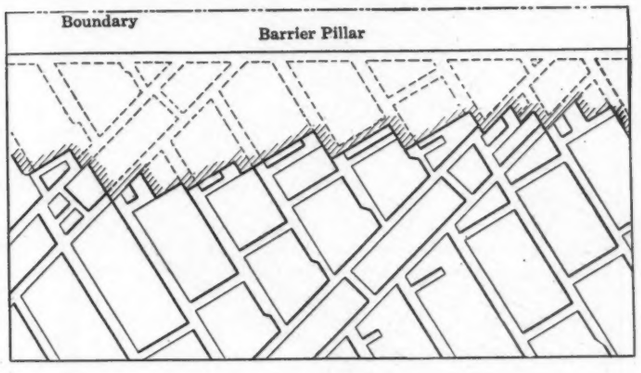


FIG. 1. GENERAL PLAN OF RIB-DRAWING, CONNELLSVILLE REGION

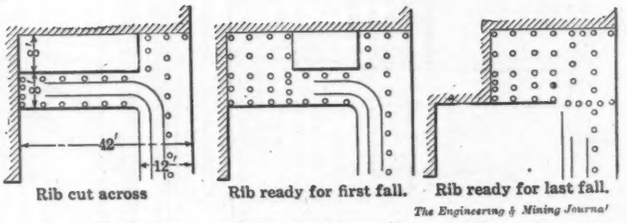


FIG. 2. DETAILS OF RIB-DRAWING. ROOMS 42-FT. CENTERS

Pick Mining Has About Disappeared

The method of mining by all-pick work subsists now only at smaller mines among the outcrop areas of the seams. By it the miner's unit of work for 12 months was, singly, to drive up a 7-yd. wide room and then bring back from the head a continuous 4-yd. rib. He had to set three rows of posts and lay wooden track going up, and could bring out most of the wood after the double use of some posts and of extra rib-posts.

The diameter of the ordinary post is 1-20 of the hight; and the cap piece, 18 in. long, 2 in. thick, and 4 in. wide, wedges the post over the top. The posts

*Pittsburg, Penn.

NOTE—Paper read before the American Institute of Mining Engineers at the Pittsburg meeting, March, 1910.

are placed in 5-ft. spans, to hold the roof-plies from raveling. Heavier timber is usually needed only where the entry opens over more than the common scant 3-yd. width required between continuous trim coal pillars to keep a track and its drain in proper order.

Method of Development

The coal mines of the Pittsburg seam are symmetrical in layout of entries, aside from gravitating drainage and transport

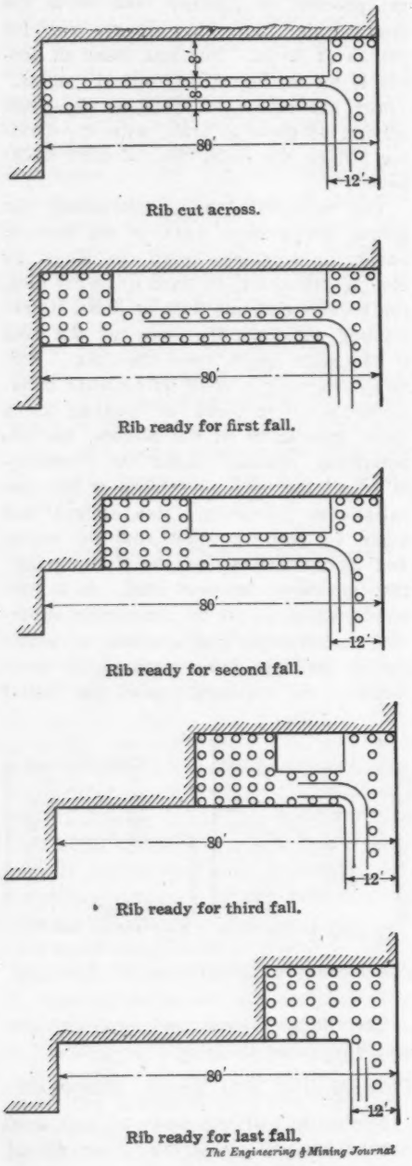


Fig. 3. Details of Rib-drawing, Connellsville Region. Rooms 80-ft. Centers

main lines. In the gas-coal districts, on light dips, the cross entries are a pair of butts in a belt 100 ft. wide, located at intervals of 500 or 600 ft. along the section entries, which are in triple, comprising a pair of haulways, with return air-course between, on the face, in a belt 200 ft. wide, disposed about every 1400 ft. along the trunk belt. The trunk belt is made 400 ft. or more wide, so as to contain the main entries for all purposes.

In the panels, which are 400 or 500 ft. on face by 1200 ft. along face, the room-and-rib working is from the opposite butt entries, but not always simultaneously for rooms to meet midway, as it may prove better to bring the roof down to settlement after the immediate retreat work of drawing out the ribs, in the 200 ft. half space, say northeast, before starting in from other tier southwest, there being then shorter roof-break lines, diagonal half end and half face along the stumps, and also more solid coal next as a barrier against settling falls. Usually, however, the rooms turn off both sides at once from the pairs of butts (in spacing along of 33 ft. or 39 ft., as rooms are to widen to 7 yd. with 4-yd. ribs or to

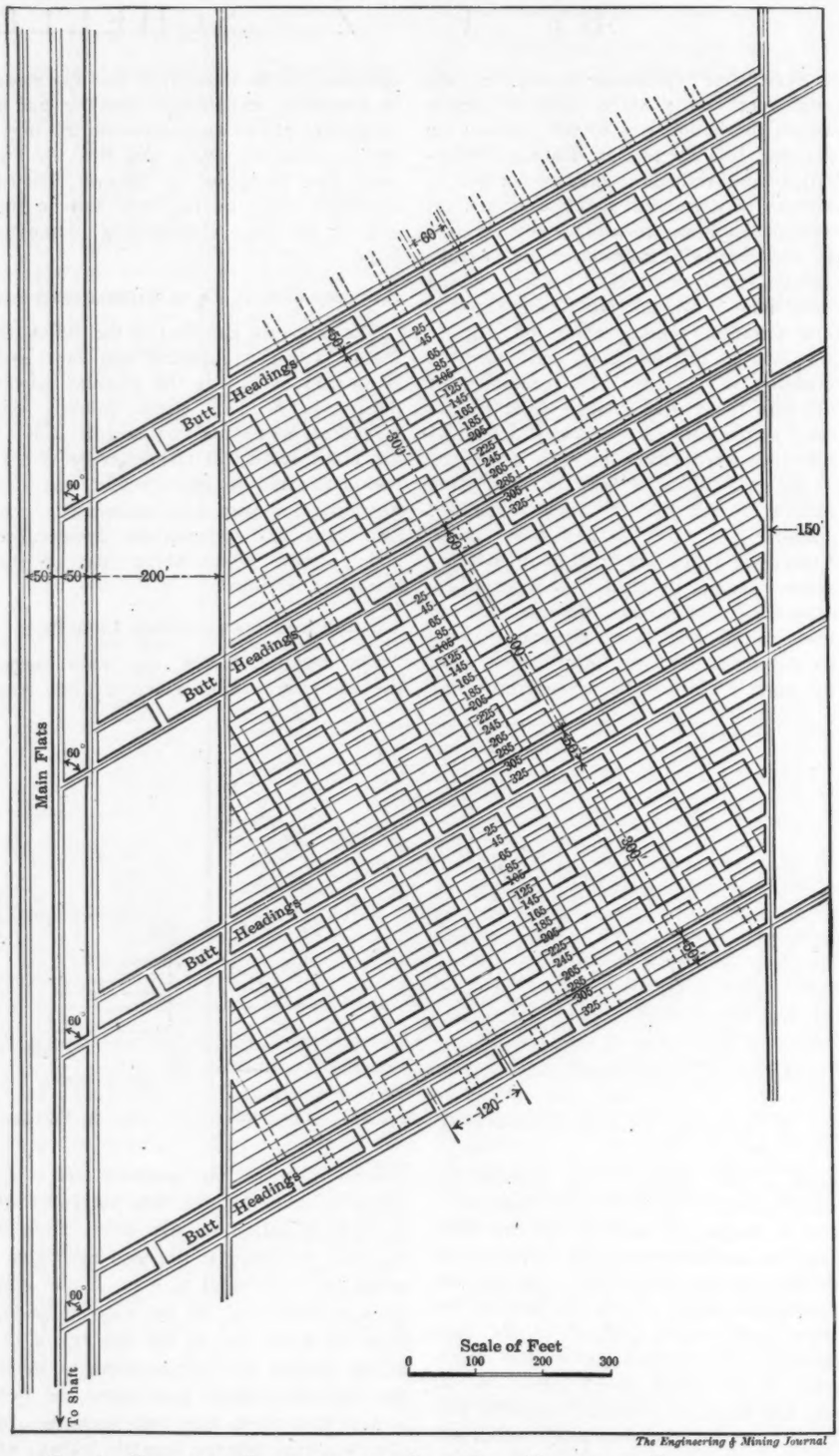


Fig. 4. Thompson-Connellsville Coke Co. Method of Rib-drawing

8 yd with 5-yd. ribs, respectively), and the retreat following is along the long break line, and as extending both ways may have straight-diagonal or broken V-shaped; the last named, however, is not so satisfactory.

The Control of Roof Settlement

There are graphical schemes in the study of the roof effect in localities, as criteria of timber cost and recovery of product, aimed to be more than 90 per cent. of the entire exhausted area. If control of roof settlement is lost by failure to secure full breaks along the margin next the stumps of coal, there is an overrunning in dynamic strains, and a squeeze will crush the coal down and a creep will raise up the soft bottom into the open space, and even the solid near by may be placed in stress if relieving roof breaks are prevented by desultory working out of the areas. In some instances, the settlement of the roof has reached through 700 ft. of cover by fissuring to the surface. The exhaustion of panel coal is intended to be independent of the removal of the entry pillars, especialy on the longer line of retreat. In the coke region, with the section entries ("flats," as skirting along the level line of strike) having butt entries 300 ft. apart with narrow rooms of 4 yd. or less between pillars of 16 yd. or more, on the rise side of the flat only, the removal of the thick ribs is attended by the withdrawal of the entry pillars also as one connected operation. So those mines are preferably developed to a boundary, and the recovery of the remainder of the coal from each area is postponed for the time.

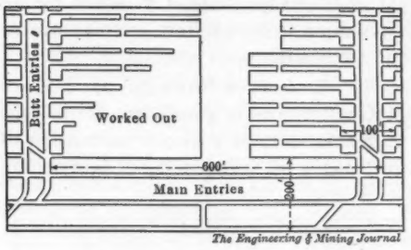


FIG. 7. METHOD OF RIB-DRAWING, PITTSBURG REGION

Diagram of Ventilating Devices

A diagrammatic map on which the width of the regular belts composing the entries is exaggerated, but the spacing of the panels is shown in mean dimensions, is an ingenious device for indicating in detail the position of the permanent and temporary appliances for directing the ventilating air currents and the lines for conducting power and other courses—as of prescribed foot travel, etc. —in the wide-showing entries, with cut-throughs where the entries are parallel and near together. Although the working areas are not shown in detail, yet the progress of exhaustion is shown plainly, so that at all stages the ventilation in broken territory may be regulated to allow the men to work in intake air, by the drawing off of the foul gases in goaves, directed to the return air course from the older works in the rear of the progressing retreat work.

Interference or Stopping of Work Causes Serious Difficulties

Interference in the progress of the mine workings is especially serious, as it inconsiderately affects the retreat workings. Interruption, stopping and starting up on short notice, imposes irregularity on all the operating conditions of the mine, and on the force of men as an adequate whole. It is contributory to accidents, and catastrophes have had such ulterior cause. It ought to be remembered that "economy" is a word derivatively meaning "house keeping." And used in its widest sense as applying to mine management, economy means conservation of living conditions so as to secure the welfare and best efforts of the men.

Of the accompanying illustrations, Figs. 1 to 4 show the methods of pillar drawing followed in the Connellsville region. Fig.

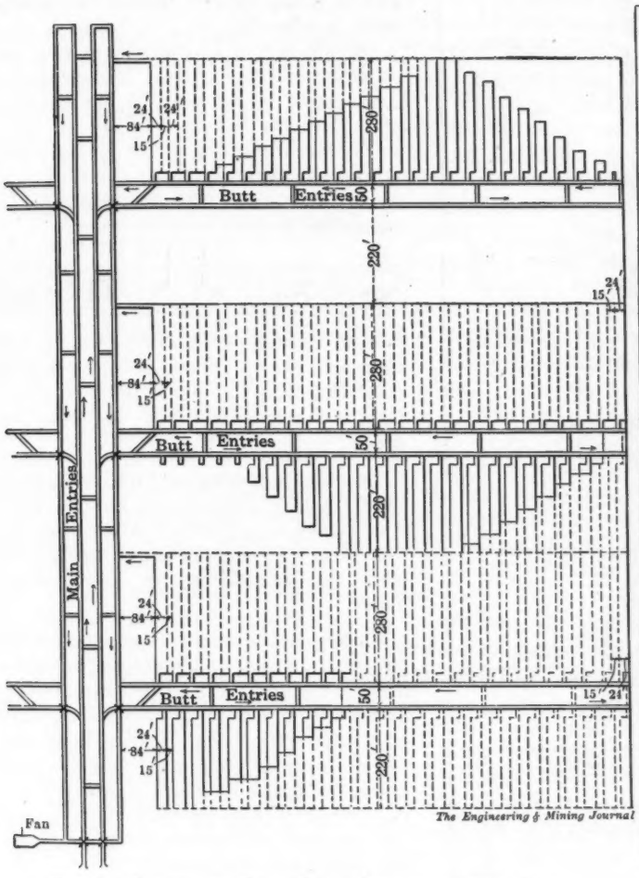


FIG. 5. PITTSBURG COAL CO. METHOD OF WORKING, PITTSBURG REGION

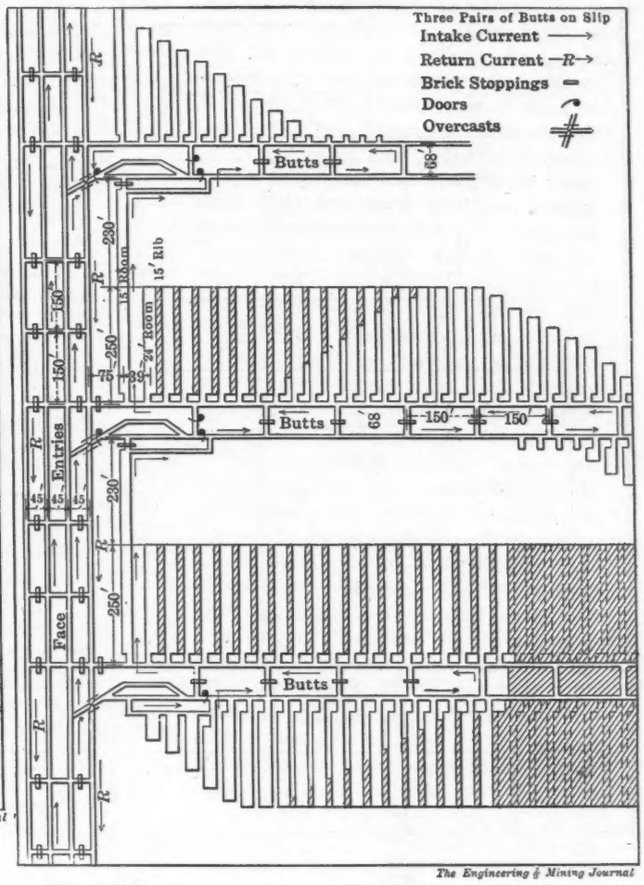


FIG. 6. MONONGAHELA RIVER CONSOLIDATED COAL AND COKE CO. METHOD OF WORKING, PITTSBURG REGION

1 shows the method in general use with hand power in this district, being that practiced by H. C. Frick Coke Company, and others; Figs. 2 and 3 give the details for rooms with 42-ft. and 80-ft. centers; while Fig. 4 is the plan laid out by John H. Rayburn for the Thompson-Connellsville Coke Company, where compressed air machines do undercutting and their aid is anticipated for initiating cross-cut slicings, marked off regularly every 20 ft.; at least until the roof has taken weight.

similar to Fig. 5 in showing together room workings on one side or both sides, a pair of butt entries at a time, as alternatives. This company's plan, shown in Fig. 8, makes complete the showing of the consummate manner in which the air circulation is saved from interference by the transport.

Fig. 7, from a drawing by Edward McGrew, shows in good form the method in general use, as a proper succession of the stages of exhaustion. Everywhere

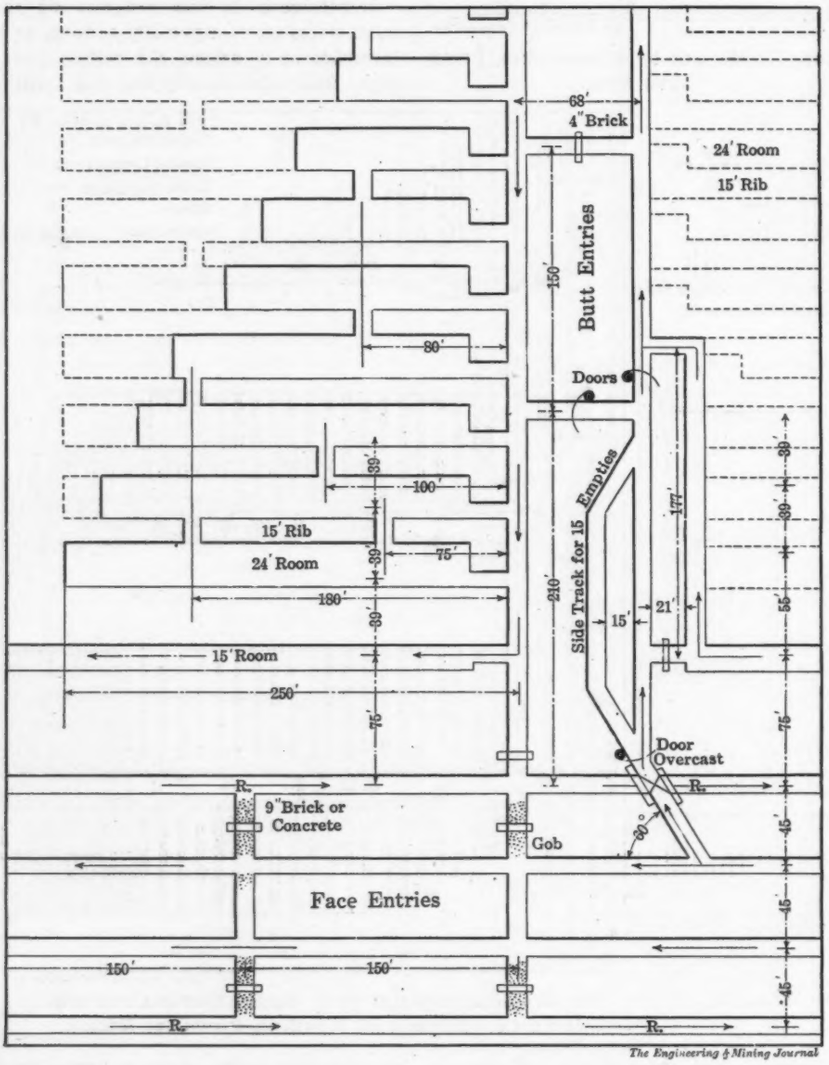


FIG. 8. MONONGAHELA RIVER CONSOLIDATED COAL AND COKE CO. METHOD OF WORKING, PITTSBURG REGION

SCHEME OF DEVELOPMENT IN PITTSBURG DISTRICT

The methods of working in the Pittsburg regions are shown in Figs. 5 to 8. Of these, Fig. 5, furnished by the Pittsburg Coal Company, is a composite plan of two types for control in rapid exhaustion across the panel. There are four face entries. Rooms are 24 ft. wide, ribs 15 ft. Fig 6, by the Monongahela River Consolidated Coal and Coke Company, is the front of breaking roof is to be a line of faces en echelon, and its rear settled broken ground or a sufficient margin of solid coal.

It is to be noted that in the Connellsville region the coal is wanted fine for charring in the coke-ovens, while in the Pittsburg region lump coal is preferred for the market. The intermediate territory provides best for the by-product ovens, so called.

Illinois Coal Operators Will Not Yield

Definite plans to oppose the striking miners have been decided upon by the Illinois Operators' Association. By unanimous vote it was decided that each member of the association should deposit a bond based upon the earnings of his mine, this bond to be sacrificed if he signed a contract with the miners without the consent of the Operators' Association.

This last action of the operators was voted upon by secret ballot and carried unanimously. A. J. Moorehead, president of the Operators' Association, said: "I am satisfied that the operators will never give in to the strikers until a fair settlement is offered."

For the benefit of the miners who are on strike in Illinois, there is now an assessment of 10 per cent. on the earnings of the Illinois miners who are at work. At the recent meeting of the United Mine Workers in Indianapolis, the result of the strike vote was 40,000 to 2000 against a resolution favoring a compromise.

COLLIERY NOTES

West Bear Ridge Colliery, owned and operated by the Philadelphia & Reading Coal and Iron Company, near Mahanoy City, Penn., was recently destroyed by fire.

An order withdrawing from entry more than 8,000,000 acres of coal land in Idaho was signed by President Taft, Aug. 24. The land was withdrawn in compliance with the administration's conservation policy.

Rioting and bloodshed came as the result of the strike of miners employed by the Pennsylvania Coal Company, at Old Forge. Shots were fired by State troopers who, after using their maces right and left on a crowd of miners, found it necessary to resort to their revolvers when the crowd turned on them with clubs. The strikers later destroyed several coal structures with dynamite.

For several years there has been a steady increase in the demand for the "prepared" sizes of anthracite coal, and this tendency has brought about a corresponding increase in the cost of handling the coal after it comes out of the mine. Such market conditions have led to a general reconstruction of coal breakers. At one time consumers may be calling for " nut," while two or three months later they all want large quantities of "egg" or "stove." The breakers, therefore, must be built so that the production of each size may be regulated according to the demand. It is also true that the companies are now mining the poorest veins, which coal requires a more elaborate process of preparation.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

J. Parke Channing will leave for Arizona on Sept. 9.

W. Y. Westervelt sailed on Sept. 7 for London and the Levant.

Arthur H. Wethey, of Butte, has returned from an European trip.

E. L. Dufourcq is expected to return from Mexico about Sept. 17 next.

T. Lane Carter, of Osgood, Carter & Co., Chicago, is examining mines in Missouri.

Fred. T. Williams, of Park City, Utah, has been at Big Pine, Cal., on mine-examination work.

Hallet R. Robbins, of Seattle, Wash., is examining mining claims in the neghborhood of Haines, Alaska.

Bertram Hunt, of San Francisco, has been at the Jewel mine in the Boundary district of British Columbia.

Robert H. Magly, for five years past general manager of the Bessie Ferrosilicon Company, Columbus, O., has resigned his position.

Dr. R. H. Richards, of Boston, last week delivered an address on ore concentration at Joplin, Mo., before a large audience of mining men.

Philip Wiseman, of Los Angeles, Cal., who has been spending the summer in Europe with his family, is due in New York, Sept. 16, on the "Mauretania."

John Young, superintendent of the Walton mine of the Monongahela Consolidated company, at Elizabeth, Penn., has gone to Scotland on a vacation trip.

Prof. R. B. Brinsmade, of Morgantown, W. Va., is in the anthracite region of Pennsylvania, studying the methods used for mining and preparing coal for market.

Dr. Joseph A. Holmes has been appointed by President Taft director of the new Bureau of Mines. Comment on this appointment will be found on another page.

Fritz Cirkel, of Montreal, is in the asbestos district of Quebec making a collection of asbestos-serpentine and its products for the Department of Mines at Ottawa.

Harold Sturges has resigned his position at the Ocotes mine of the Teziutlan Copper Mining Company, and will take up some options in the Tlacolula district, Oaxaca.

W. L. Cummings, geologist of the Bethlehem Steel Company, returned on Aug. 30 from a short trip to Cuba. His permanent address is 319 North High street, Bethlehem, Pennsylvania.

Arthur W. Jenks has gone to Chilecito, Provincia de Rioja, Argentina, for Hooper, Speak & Feild ng, as resident manager of the properties of the Famantina Development Corporation.

Edward Slade, formerly of the British Canadian Asbestos Mines at Black Lake, P. Q., has been appointed general manager of the Black Lake Consolidated Asbestos Company at Black Lake.

Prof. E. S. Moore, of the geological department of the Pennsylvania State College, is preparing a report for the Ontario government on the mineral conditions of the Sturgeon Lake district.

G. G. S. Lindsey, of Toronto, formerly general manager of the Crow's Nest Pass Coal Company, has gone to British Columbia to inspect the Portland Canal region and the coal-mining districts on the Grand Trunk Pacific road.

Francis L. Robbins, formerly president of the Pittsburg Coal Company, and now president of the Mobile Portland Cement and Coal Company, of Mobile, Ala., has been in Pittsburg buying machinery and structural steel for his company.

James White, Ottawa, for years chief geographer for the Canadian Department of the Interior, now secretary of the Canadian Commission of Conservation, is in British Columbia obtaining information relative to the water powers of that province.

J. E. Johnson, Jr., whose resignation as general superintendent of the Thomas division of the Republic Steel and Iron Company, was recently announced, leaves that company to become manager of the Ashland plant of the Lake Superior Iron and Chemical Company, at Ashland, Wisconsin.

M. H. Fies, of Birmingham, Ala., has resigned as general superintendent of the Birmingham Coal and Iron Company, and has leased and is operating Short Creek No. 1 mine. Mr. Fies' successor has not yet been appointed, the work being handled temporarily direct by Mr. James Bonnyman, general manager.

George E. Roberts has been appointed director of the United States mint, to succeed A. Platt Andrew, recently appointed assistant secretary of the treasury. Mr. Roberts was director for several years, resigning two years ago to become president of the Commercial National Bank at Chicago. He is thoroughly versed in the operations and affairs of the department to which he now returns.

OBITUARY

Thomas F. Griffin, formerly manager of the iron-ore department of Corrigan, McKinney & Co., Cleveland, O., died at Colorado Springs, Colo., Aug. 29, aged 42 years.

William R. Dowling was killed in an automobile accident near Saxonburg, Penn., Aug. 28. He was 26 years old, and was assistant superintendent of the open-hearth furnaces of the Jones & Laughlin Steel Company, Pittsburg.

Frank Robertson, superintendent of the Tiro General mine at Charcas, San Luis Potosi, Mexico, was killed in the mine, Aug. 21, by an ore car, which fell down the shaft. He had been in Mexico for a number of years, and was for some time at Guanajuato before going to Charcas.

Austin Heckscher, president of the Richard Heckscher & Sons Company, Philadelphia, died Aug. 27, at Westerly, R. I., aged 52 years. He was early associated with his father, the late Richard Heckscher, in the development of the Kohinoor coal mines in the anthracite regions at Pottsville. In 1886, together with his father and brothers, he leased the then idle blast furnaces at Swedeland, Penn., from the Philadelphia & Reading Coal and Iron Company, and effected their purchase in 1892. Under Mr. Heckscher's presidency and progressive policy since 1901 the plant has been greatly enlarged and modernized. The company has recently become affiliated with the Alan Wood Iron and Steel Company. He was also a director of the Central National Bank, Philadelphia.

Lucius A. Cole, president of the National Lead Company, died on Aug. 25, at Carlsbad, Austria. It had been the custom of Mr. Cole for several years to go to Carlsbad, to take the baths there. Mr. Cole was born in Columbus, O., 62 years ago. He spent his youth in Columbus and Cincinnati. He went to Parkersburg, W. Va., and in 1890 came to New York. The next year the National Lead Company was formed, with Mr. Cole as its treasurer. He served successively as vice-president and president, holding the latter office since 1896. The National Lead Company is not only the largest corroder of lead in the United States, but also is an important miner and smelter of lead ore. Mr. Cole had lived in Lewellyn Park, West Orange, N. J., since last June. His home for 18 years previous to that was in East Orange. He was a director in the Seaboard National Bank, the New Amsterdam Casualty Company and the Assurance Company of America. Mr. Cole left a widow, who was Miss Emma Straub, of Cincinnati, three sons and three daughters.

SOCIETIES and TECHNICAL SCHOOLS

Lake Superior Mining Institute—The officers for the ensuing year are as follows: W. J. Richards, Crystal Falls, Mich., president; John M. Bush, Frederick W. Sperr, James H. Rough, E. D. Brigham and C. H. Munger, vice-presidents; Charles E. Lawrence, William J. West, Peter W. Pascoe, L. C. Brewer and J. B. Cooper, managers; A. J. Yungbluth, Ishpeming, Mich., secretary; C. W. Hopkins, Commonwealth, Wis., treasurer.

EDITORIAL CORRESPONDENCE

Reports From Our Own Representatives on Important Events From Many Important Mining Centers of the World

San Francisco

Sept. 1—There seems to be coming a revival of drift mining in Nevada county where there are still large bodies of auriferous gravel which have never been mined. One of the most ambitious of the new projects is the reopening of El Oro mine near North Columbia, where C. D. Dean is in charge of operations, cleaning out and retimbering the tunnel to get access to old workings. The mine is on an extension of one of the channels which formed the Big Blue lead at North Bloomfield. Only the rims of the channels were worked in early days, the main channel not having been reached. There is an estimated length of 1000 ft. of channel to be worked. Another drift mine being reopened is that at Steep Hollow which will be worked by the Sierra Gold Mining Company. Here another portion of the Blue Lead channel will be worked. The present tunnel is to be extended a considerable distance to reach the auriferous-gravel channel. Large sums were mined from other portions of this channel in early days.

The monthly production of oil in California has now nearly reached the 7,000,000 bbl. mark. The surplus above consumption is now rated at about 12 per cent. In July the San Joaquin Valley fields yielded 5,301,016 bbl.; the coast fields 721,005; and the southern fields 879,941. The Lakeview, American Oilfield and Consolidated Midway gushers are now equaling the output of the whole Coalinga and Kern fields put together so that some of the oil men are beginning to think there may be something in the conservation of oil lands after all. At a recent meeting in Los Angeles several prominent oil men expressed themselves in favor of the conservation policy as wise for the Government and the oil men also.

Denver

Sept. 4—The ore output of the mines of Colorado for August is estimated at approximately $2,500,000 gross. Cripple Creek is credited with 72,089 tons, of a gross value of $1,366,044; Leadville with 74,000 tons, of an estimated average value of $10 per ton; Silverton 5275 tons of ore, gross value, $26,375; Georgetown district, $13,750. Then there is Telluride, Gilpin and Clear Creek counties, and other smaller camps to hear from, so that the above estimate is under, rather than over the mark. All the camps show a big increase over July, Cripple Creek having an increase of 20,268 tons for August. September will in all probability far exceed August.

Owing, it is stated, to a lack of tonnage, the North American Smelting and Mines Company, operating the smeltery at Golden, has announced an advance in its treatment charges. This plant, which gets its ore supply from Gilpin and Clear Creek counties, has not been running at full capacity for some time past. The management as an inducement to the producers states that as soon as sufficient ore is received to allow the plant to run at full capacity, the old rate will be resumed. It is just reported that J. M. Meyers, the superintendent, has discovered in the old dump at the French smeltery, which was erected in '79, and now owned by the North American Smelting and Mines Company, "ore that promises to net $100,000." Some workmen making a new roadway exposed a section of the old dump a few days ago, and it is reported that it was found to contain gold, silver and copper, and so this great pile which has laid there for 30 years will be retreated.

The mining committee of the Denver Chamber of Commerce, Franklin Guiterman, chairman, is going to make a careful study of such mines as have failed in this State, and the reasons therefor. To this end, a printed form, embodying a set of questions, is to be sent out to each mining company. It is probable that in 90 cases out of 100, the answers will tend to placing the blame on the property instead of the incapacity, dishonest or otherwise, of the men at the head of it, and it would seem that a much surer plan of obtaining the truth would be to send a "rubber-shoe" man, in the shape of an intelligent and trustworthy miner of long experience in the State, who would visit each camp and "sit around" generally and talk to the miners. He would get inside information in this way that could not be obtained by sending around circulars, and the general sentiment and opinion of the miners of a camp is, as a rule, very close to the correct mark. This plan would cost more perhaps, but the results would be reliable.

The reason given by the management for the suspension of operations at the Kuenzel smeltery at Buena Vista are the difficulty encountered in maintaining a sufficient ore-buying fund, and the "seepage of the molten metals through the brick foundations inside the stacks." The matte which was produced by the 10-days run, in the four out of the eight furnaces, is being held until the refinery is completed. It is stated that the Eastern stockholders and directors are now raising an ore-buying fund, and that operations will be resumed.

Butte

Sept. 4—The forest fires throughout the State have been checked by recent rains and the situation looks better than at any time within the past several weeks. The exact amount of damage done to the mining industry will not be known until reports have been sent in from the isolated camps, but it will undoubtedly figure up to a large total.

The fires have swept over a part of Lincoln county destroying considerable mining property. At the Shaughnessy Hill group operated by McCorkle & Town, the fire wiped out all of the surface plant. It will be reconstructed at once, and operations resumed. The town of Sylvanite was totally destroyed and with it the plant of the Lincoln Gold Mining Company including its recently completed stamp mill.

Reports from Idaho say that the damage to mining property, while large in the aggregate, is small individually, and will quickly be restored.

At the Bullion mine, Idaho, eight men lost their lives in the tunnel where they sought shelter during the forest fires. Sixteen escaped and reached Wallace, and it is believed that 20 men have been killed at Avery and Grand Forks. Employees of the Hercules and Hecla mines at Burke saved the great plants of those properties and 200 men are still guarding the flumes carrying the town's water supply. For a time it was feared the Standard and Mammoth mills were destroyed, but they remained uninjured. The fire followed the hills to Mullan and Burke, and grave fears for both these towns were entertained. The damage will not be great in either place.

The "smoke case" is apparently to be renewed this fall. Some months ago the Attorney General of the United States, acting on representations made to him by the farmers of Deer Lodge valley, filed a suit against the Washoe Smelter Company alleging that vegetation was being destroyed by the fumes from the Washoe smeltery at Anaconda. It is the same case which was heard before Judge Hunt, but the findings in the case were not considered satisfactory, so the Government was induced to take the matter up. Expert chemists are now in the Deer

Lodge valley taking samples of the soil and examining the trees, vegetation and grain. The Anaconda company has experts also making tests, and the taking of testimony is expected to be even more extended than it was in the smoke case of more than a year ago. Considering the dryness of the season, the crops in the Deer Lodge valley never looked better and this will, of course, be taken advantage of by the Anaconda company to show that the alleged poisonous gases and the arsenic from the stack of the smeltery are not as destructive to the grain and vegetation generally as represented by the ranchers.

Goldfield

Sept. 3—The much talked of Goldfield-Ely railroad will be built in the near future, says the latest report. Engineers who have been examining the situation from the standpoint of available ore tonnage, along the proposed route have, it is said, completed their work and are ready to make a favorable report. It is also reported that the financial end of the project is being arranged for in New York. A number of camps, including Hamilton and Tybo, are on the surveyed line and a 16-mile branch would connect with Eureka where the United States Smelting Company owns the Richmond Eureka property.

The production in Nye county for the second quarter in 1910 according to the reports thus far submitted to the bullion tax collector was $1,965,319. The net yield was $383,241 on which the tax paid was $13,450. This shows an increase over the first quarter of $5374. The companies included are Tonopah-Belmont, Montana-Tonopah, Tonopah, Tonopah Extension, and the Round Mountain company, of Round Mountain.

The Dexter Consolidated Mines Company, with property in Manhattan, has been organized to include the holdings of the Dexter, Stray Dog and Jumping Jack companies. The exchange of stock is to be based on the appraisement of a board composed of John G. Kirchen, Malcolm L. McDonald and S. H. Brady. All existing litigation has been dismissed and leasers' agreement has been ratified to provide for the immediate resumption of work. Following directors were elected: Messrs. Harris Kirchen, Van Dyck, Symmes, Zadig, Hudson and Raycraft.

Salt Lake City

Sept. 4—The American Smelting and Refining Company has made a contract with the Yampa mine for 600 tons of ore a day, to take the place of the heavy sulphide ores previously secured from the Utah Consolidated. At present the Garfield plant is operating three blast furnaces out of four, and is running five reverberatories. In the neighborhood of 200 tons of copper are produced daily. A new system of converting, in which basic-lined converters of the Pierce & Smith type are used, has been adopted. The converters are of unusual length, being about 20 ft. long, and 10 ft. in diameter. The shells are lined with magnesia brick, and are capable of turning out from 35 to 60 tons of blister copper per charge. They are said to be able to run 1800 tons of copper without relining. The magnesia brick is more expensive than the ordinary silica lining, and the mechanical difficulty of holding it in place is greater, but it does not need to be renewed after each charge. Five converters of this type have been installed, and four are in use. The Utah Copper concentrates run about 26 per cent. silica. As the slag is not derived from the lining, some of the raw concentrates are charged in the converters direct, with the matte at intervals, in order to form the silicious flux with the iron oxide. It is planned to increase the capacity of the Garfield plant by the addition of more reverberatories. At the Murray plant the normal tonnage is being handled. Six blast furnaces are in operation; of these five are working on lead ores and one on matte concentration.

There have been an unusually large number of entries on coal land in Emery county recently. On Aug. 26 and 27 the receipts of the local United States land office amounted to $18,000. The land was taken up largely by Chicago interests.

Birmingham, Ala.

Sept. 6—Efforts to bring foreign members of the American Iron and Steel Institute to the Birmingham district after the meeting in New York in October are not abating and invitations will be extended in the expectation that they will be accepted. Birmingham members say that the time that will be alloted by the foreigners to the proposed trip after the October meeting will depend on Birmingham being included in the itinerary.

Two sites have been offered the Government for the rescue station in the Birmingham district. At first it was expected that the Government would buy its site; but when word came from the department at Washington that there was no appropriation for that purpose, donations of sites were offered. A rescue station that will cost about $5000 will be built and trained men placed in charge. It is proposed to place men here who will be training local men in the rescue work all the time so that there will be no loss of time.

Cobalt

Sept. 4—Since the slump in the market for Cobalt stocks, the opinion has been gaining ground that it reflects the condition of the mines. In view of this, it is interesting to note that practically all the heaviest producers are expending large sums of money in improvements with a view to increasing their output. For the first seven months of 1910 the total tonnage shipped was 18,029 tons, as against 29,942 for the 12 months of 1909. On account of the greater amount of concentrates shipped the average value is also higher, being estimated at $424 per ton. The value of the seven months output is approximately $8,320,000 or at the rate of over 26,000,000 oz. for the year.

The Timmins-McMartin Syndicate, the largest operators in the Porcupine camp, have purchased a half interest in the Sandy Falls water power. The preliminary work on this undertaking is now being done, and power is expected for next June. The small mill on the Timmins property is treating about five tons of ore per day, from which the average cleanup is about $1000.

Several good discoveries have lately been made in the vicinity of Elk Lake, and conditions in that district appear to be slowly improving.

Mexico City

Sept. 1—The National Railways, the Merger system, controlled by the Mexican government, has acquired the Veracruz line running from the port of Veracruz to connect with the Tehuantepec line. The line is 297 miles long and is an important link in the plan for the complete nationalization of the Mexican roads.

Special interest is shown in the activities of a French syndicate in the Mexican mining field. This syndicate has purchased recently the Cruz del Aire mine in Nuevo Leon for 500,000 pesos and also the Pachonas group in the same State for 5,000,000 pesos. A railroad will be built to serve these properties. The same interests hold an option on the Cigarrera mine in Chihuahua. These important negotiations indicate a strong new factor in the Mexican field. The French interests in Mexico heretofore have not been large. The French residents have had part in various mining undertakings. In recent years the stock of the Dos Estrellas mine in El Oro district has been largely traded in in Paris. The Esperanza of El Oro has been admitted to the Paris bourse. More recently a Paris brokerage house has taken a development option on property at El Oro. The French Rothchilds have long had very important mining interests at Boleo in Lower California and in Michoacan. The later are inactive for lack of a railroad. Other French interests control the Encinillas mine and smelting plant at Santa Rosalia in Chihuahua and they have recently bought valuable zinc mines in eastern Chihuahua.

It looks as though the French investments in Mexican mining will be of magnitude and will be a factor in the great development of the industry.

THE MINING NEWS

Reports of New Enterprises, New Machinery, Installations, Development Work and Property Transfers The Current History of Mining

Alabama

FAYETTE COUNTY

Providence Oil and Gas Company—At the annual meeting in Birmingham, Ala., Aug. 30, the opposition party was voted down and the old board reëlected, as follows: G. B. Crowe, H. W. Davis, E. W. Rucker, H. J. Falls, J. W. Miller, J. W. Whatley and J. L. Davidson. The board elected Dr. G. B. Crowe, president, H. C. Falls, vice-president and treasurer; James L. Davidson, secretary.

JEFFERSON COUNTY

Alabama Consolidated—The new coal tipple at Etowah, to replace the old one lately burned, is nearly completed. The new iron ore washer and concentrator is now ready for use.

Arizona

COCHISE COUNTY

Peacock—A. H. Anderson, secretary, has raised funds in the East for continuing development. The property is in the Johnson camp.

PIMA COUNTY

Southern Nevada—This smelting company, represented by H. J. Thompson, announces that money has been provided for the erection of a 30-ton smelting plant near Tucson.

PINAL COUNTY

Ray Consolidated—The company is sinking a second operating shaft on the west end of its territory which it is planned to have connect on the second level with No. 1 shaft. This connection will give a drift one mile long and it will be in under or over ore for its entire distance. The new mill is approaching completion, the steel work being nearly all up, and it is now believed that Ray will enter the producing ranks before 1911.

YAVAPAI COUNTY

Arizona Mines Company—This company is being financed in Boston. The property consists of 144 acres in the Castle Creek district, and 1000 ft. of openings have been made. David E. Dow is president.

California

AMADOR COUNTY

Forty-Nine Flat—After several years tunnel work, A. L. Reale and partner have struck gravel in the channel near Upper Rancheria.

Bunker Hill—An important strike has been made in this mine at Amador City, E. H. Harrington, superintendent. A seam of quartz was followed north of the shaft and opened into an orebody on the 1950 level in the Mayflower ground.

Alpine—The company has bought the Alpine mine at Plymouth, adjoining the Plymouth Consolidated. John L. Henry is superintendent.

CALAVERAS COUNTY

Table Mountain Consolidated—This company will work extensively a portion of the gravel channel a few miles west of Columbia, near Parrotts ferry. The channel is under Table mountain and the gravel was tapped by incline at the depth of 150 ft. J. B. Allen is manager. New machinery has been installed.

Oriel—This mine in Mokelumne river district, owner by Henry Schrag and John Casey, of Andreas, has been placed under bond and operations will be commenced.

ELDORADO

Montezuma—New machinery has been installed at this mine at Nashville, F. H. Nettleton superintendent. Deeper sinking will be done and new levels opened.

Roundout—A company called the Livingstone Gold Mining Company has been organized to work this mine at Smith flat a few miles from Placerville. H. G. Fairchild, who owns the gravel ground, is one of the directors.

Sherman—This mine at Placerville keeps 10 stamps busy from the 300 to 600 levels. George Clark is superintendent.

Landecker—Extensive machinery is being placed on this gravel mine three miles from Placerville. H. C. Plummer superintendent.

Eldorado Water and Deep Gravel—This company, A. Baring Gould, manager, is opening the Excelsior gravel mine in Placerville district and also the Pacific-Maryland quartz mine.

INYO COUNTY

At Oasis camp the Copper Queen mine is showing up some high-grade copper ore, and free milling gold ore overlooked by the old prospectors has also been found. The Schwab properties south of this group contain wide veins of good copper ore and are being developed.

Silver Bell—C. B. Burr has taken charge of this mine in Ubehebe district for the Monterey Gold Company and a long tunnel has been commenced.

Monster—A wagon road is being built to this mine from Citrus, and the mine will be worked again.

Lost Frenchman—Joseph Ward of Big Pine claims that he has found this much sought for mine in the southwest end of Deep Spring valley and is taking out high-grade ore.

SHASTA COUNTY

Milkmaid—D. O. Lindbloom, who has had this mine at French gulch under bond for nine months, has given up his bond and the Western Exploration Company has again taken possession and will continue to develop.

Afterthought—After being closed for two years this property at Ingot will be operated. Ore has been found on the 300 level.

Mammoth—Since the installation of the baghouse July 1, the company has been running but two furnaces, but now another furnace will be run. The fumes are hereafter to be forced through the bags and cooling pipes at a lower rate of speed, and additional draft will secure better ventilation, so there will be less heat on the bags.

SISKIYOU COUNTY

Lucky Strike—At this property, Etna Mills, the finding of a new oreshoot at the surface has caused temporary suspension of work on the new shaft and the new find is being opened.

TEHAMA COUNTY

In the vicinity of Tom Head copper mine, a discovery of lead ore has been made and work has been started upon it.

TRINITY COUNTY

The assessment rolls show that there are 1846 mining claims and 584 miles of mining ditches in the county.

Trinity—This company at Carrville, David Goodale, manager, will soon have its 200-ton cyanide plant in operation. A power plant and flume are under construction.

TUOLUMNE COUNTY

Lack of water has compelled the Tuolumne Power Company to discontinue power to a number of mines in the county.

Fair Oaks—At this mine, near Confidence, James McMahon, manager, development work is going on and the mill has been started.

Colorado

CLEAR CREEK COUNTY

Metropolitan—This tunnel company will drive a drainage and development tunnel from near the junction of Trail and Clear creeks to the property, a distance of 4000 ft. Machine drills and compressed air from the Hoosac plant will be used.

Amos R. Christ, of Philadelphia, is president.

TELLER COUNTY—CRIPPLE CREEK

Dan McDonald—This mine, lying between Guyot hill and Beacon hill, under lease to Joseph Brentlinger, is said to have a discovery of 2 ft. of pay ore at 25 ft. below the surface.

Chicken Hawk—This mine, also on Guyot hill, and operated by the Columbia Mining and Development Company, is mining pay ore at the 700 level. Guyot hill lies between Beacon and Raven hills, two of the richest in the district, and is now being actively explored.

El Paso-Gold King—This mine, in Poverty gulch, leased by Owen Roberts, is producing about 800 tons per month of $15 to $20 ore.

American Eagles—From this mine, which is owned by the Stratton Estate, 14 cars of gold ore were shipped in July, of an average value of $50 per ton. August output will be larger and higher grade. The property is leased to the Colorado Mines Investment Company.

Doctor-Jack Pot—From this mine on Raven hill, Whitford & Co., lessees, sent out a 100-ton shipment this week, of an average content of $40 per ton.

Stratton's Independence—The cabled July results: Production, 1470 tons, averaging 26 dwt. 6 grains per ton. Dump-ore milled, 8100 tons. Net working profit at both mine and mill departments, $11,310, less special development, $1580.

SAN JUAN DISTRICT

Barstow—This property, in the Red Mountain district, under the management of C. R. Wilfley, of Denver, is being worked again, and the main development tunnel is to be driven 2000 ft. into the mountain, for the purpose of reaching the rich shoots of gold ore which were worked nearer the surface some years ago.

Illinois

Several of the mines in the Pioneer district have signed the scale demanded by the miners and have gone to work. These include mines at East Peoria and Auburn. The Ubben mine in the Pekin district has also accepted the scale and goes to work this week. This is the only mine in the Pekin district that has come to terms.

East Side Coal Company—The new shaft at Edwardsville, in Madison county, has struck a 7-ft. coal bed at 140 ft. This is the third shaft to reach coal near Edwardsville.

Indiana

CLAY COUNTY

Local coal miners are complaining of the striking Illinois miners, who are coming into this territory in great numbers and trying to get places in the mines. They declare that thousands of the men the Indiana miners are supporting with $1 a week assessments are trying to make it impossible to pay these assessments. In reply the miners from Illinois say that by coming into this field and going to work they are reducing the number of families in Illinois requiring support.

DAVIESS COUNTY

A gas explosion occurred in the Kelley & Walker coal mine, two miles south of Washington, Aug. 30, badly damaging the mine and injuring the foreman. The mine had been closed for a few days, undergoing repairs, and it was intended to reopen it next day. The foreman went to the mine in the morning for the purpose of starting the pumps. With a miner's lamp he went near the air-shaft. An explosion occurred, carrying away the supports, causing a heavy fall of earth and wrecking the air shaft and injuring the foreman seriously. Little trouble had been experienced from gas and this fact made the foreman careless.

GIBSON COUNTY

The miners and operators in this county have been notified that an expert from the Urbana (Ill.) mine rescue station will visit mines to give demonstrations on the new methods of mine rescue work, beginning Sept. 8. Similar instructions will be given at the mines in other districts.

VIGO COUNTY

While there was an advance of 15c. on slack and 25c. on block coal at the mines in this district Sept. 1, the future prices are uncertain, since the operators are daily expecting a settlement in the Illinois field. No orders were received from Chicago for some days.

Michigan

COPPER

Franklin—No. 1 shaft on the Pewabic lode is sinking below the 30th level and a crosscut is being driven from that level. Drifts from the upper levels are being extended in both directions and are showing a good commercial grade of rock. No. 3 shaft is bottomed at the 16th level where sinking has been suspended owing to the lack of larger hoisting facilities.

Superior—The north drift from the 650-ft. level of No. 2 shaft has entered encouraging copper ground; this is the most important development in this shaft which is down 750 ft. No. 1 shaft continues yielding good results, shipping between 300 and 400 tons of rock daily to the Atlantic mill.

South Lake—No. 4 drill hole has penetrated another copper-bearing amygdaloid lode at 1090 feet.

Indiana—No. 7 drill hole is within a few feet of the estimated depth at which the Indiana lode is expected to be reached.

Ahmeek—The new Nos. 3 and 4 shafts are down 1050 ft. and at 975 ft. started to curve to conform to the pitch of the formation which will be reached at 1250 ft. Drill holes from points in the shafts found the lode in place and well mineralized.

Mohawk—A crosscut is being driven to cut the lode at the 415-ft. level of No. 6 shaft. Drifting is under way from the two levels above with average ground throughout.

IRON

The United States Steel Corporation has started the exploration of a large tract of mineral-bearing land in the vicinity of Clowry, in the western portion of the Marquette range. Two diamond drills have been put into commission and they will be kept at work indefinitely. A small portion of the area known as the North Champion mine, was opened on a limited scale some years ago by the Champion Iron Company, now controlled by the Steel Corporation, and a few thousand tons mined.

The Cyr property, in the southern part of the Marquette region, is being provided with railroad facilities. The Cyr is the latest Swanzy district property, the development of which has been started by the Cleveland Cliffs company. The surface material is of sandy nature and the property is being opened by means of a concrete shaft.

The Richmond mine in the Cascade district of the Marquette range is one of the very few Michigan iron properties operated on the open-pit plan. The pit is more than 1000 ft. in length and averages 40 ft. in depth; its greatest depth is 60 ft. Stripping has been in progress most of the year, but it has now been suspended.

The Munro mine, a Menominee range property, at Norway, is resuming operations after being idle a number of months. The Munro is an open-pit mine, on the "milling" system.

The output of the Florence mine, the largest property in the Wisconsin portion of the Menominee range, will be increased to fill existing contracts. The Florence mine is a property of the Industrial Securities Company.

The Warner property of Pickands, Mather & Co., is in commission after several weeks' idleness. This property is in the Amasa field of the Menominee range. It is still in its exploratory stage.

Missouri

The Frisco railway company has bought the land containing the Ruth mine over which the track runs, and is filling the stopes, which are from 50 to 100 ft. high, with mine tailings. These are being put into the ground through large drill holes. The company is also reinforcing some of the pillars with concrete work. The railway has been aban-

doned over this mine for a number of months but traffic will soon be resumed.

Little Mary—This mine at Neck City, which has just made its initial run, produced 25 tons of concentrates in one shift.

Oronogo Circle—This company has decided on the abandonment of the Nos. 1 and 3 mills and will enlarge No. 5 mill to about 800 tons capacity and handle all the ore over this plant. It figures on a large saving by concentrating the plants into one large one. It has taken out its three steam pumps and installed one 3-in. two-stage turbine pump, motor driven. After drilling with a Keystone drill from the 236-ft. level, the Calyx shot-core drill was tried from the 236-ft. level with great success. A 3¼-in. hole was put down 67 ft. and all but 18 in. of the core recovered. Crevices were crossed successfully. The cost for the first hole was $2.50 per ft., which will be greatly reduced in the other 12 holes which will be drilled.

Montana

BUTTE DISTRICT

Anaconda—At the Mountain View the air shaft is being raised from the 1800-ft. level to the 1400-ft. level which will take about two months. On the 1400-ft. level a connection was recently made with the West Colusa mine. About 1000 tons is shipped daily. The Pennsylvania mine is shipping about 800 tons daily, which is about 75 per cent. of its average shipments in March, 1910. On the 1800-ft. level a raise is being run to connect with the 1800-ft. level of the St. Lawrence, a distance of 90 ft., to mine the ore given to the Pennsylvania a number of years ago by the decision of the court. At the Leonard the retimbering of the old No. 1 shaft is nearly finished and the output is approximately 75 per cent. of the normal. At the Badger State, crosscuts have been run north and south on the 1800-ft. level. In the north crosscut a connection was made with the north crosscut on the 1800-ft. level of the Diamond mine. A number of small leads shown in the Diamond crosscut have been drifted on a short distance. In the south crosscut a lead was struck about 40 ft. south of the shaft and is now being drifted upon. About 30 railway cars are being shipped monthly.

Parrot—Unless there is delay the suit brought by Boston stockholders for the appointment of appraisers to value the property, will come up in the district court in Butte Sept. 12. The stockholders object to the sale of the property to the Anaconda company for 90,000 shares of stock, claiming that the Parrot is worth more.

North Butte—The shaft will be put down to 2800 ft. It is now about 2400 ft., while the lowest level at the present time is 2200 ft. It is the intention to open levels on the 2400 and the 2800. A short time ago a winze was sunk 200 ft. from the 2200-ft. level on the vein and good ore encountered.

MADISON COUNTY

Reality—Fred Stock has begun suit against this company for approximately $3000 and has attached the property. The company recently leased and bonded the Bozeman group of gold claims from the Elling estate and J. W. McKitrick for $25,000 but has not made any payments.

Nevada

ESMERALDA COUNTY

Jumbo Extension— Six sampling crews and a party of surveyors under the direction of Bryan K. Morse, are at work on a completed examination of the Vinagorone and adjacent ground. Similar work on the Polverde and Diamondfield ground will follow. It is announced that active operations will begin soon.

C. O. D.—Several drifts and a raise from the 400-ft. level continue to show ore breaking above $10, and higher-grade rock is expected at any time.

Goldfield Daisy—Large stockholders are planning a reorganization of the company. The time allowed for the redemption of the property, sold at sheriff's sale last April, expires in October and it is hoped to straighten matters out before that time.

HUMBOLDT COUNTY

Stall Brothers—This lease at National has recently been sold for $500,000. The lease expires April, 1911. Both the Stall brothers were recently injured in the mine by a cave in, and were badly crippled.

LINCOLN COUNTY

Bamberger-Delamar—The 500-ton cyanide mill equipment, including motors from five- to 100-h.p., 75 tanks, 10 chilean mills, Gates crushers, electric locomotives, five miles of rails and 30 miles of water pipe, has been sold by the receiver to the Great Western Machinery Company, of Denver.

LYON COUNTY

Mason Valley—Jules La Barthe, general manager, says that the railway is now graded to within a half mile of the smeltery site, and contracts have been made for the excavating for the smeltery. Surveying has been completed for the tramway from the mine to the railroad at Mason City, a distance of about one mile, and construction will proceed with rapidity.

NYE COUNTY

West End—A new vein carrying milling ore has been encountered at 75 ft. from the main vein. The orebody has been tapped at intervals for 200 ft., showing an 8-ft. shoot.

Mantana Tonopah—The weekly report shows 1011 tons crushed and treated with an average extraction of 91 per cent.

Tonopah—New ground broken during the week ended Aug. 27, amounted to 622½ ft. exclusive of stoping. An electric sinking pump will be substituted for the air installation now in operation.

WASHOE COUNTY

Springfield-Nevada—A lease and bond on the large acreage of the company at Olinghouse has been taken by Huskey & Springer, of Reno, and the new proprietors plan extensive development through sub-leases.

Ohio

Wonderland Coal Company—This company has removed its main office from Portsmouth to Columbus, O. It has acquired control of the Pomeroy Coal Company, with mines at Hobson, on the Hocking Valley railroad.

Oklahoma

Emma Gordon—This company is preparing to pull all the pillars in the mine at Miami and is building cribs or pens of square timbers on all sides of the pillars before their removal is attempted. While this is very expensive, the value of the pillars is so great that this method will pay. The hight of the cribs will be from 12 to 18 feet.

Vinita—In drilling at Vinita, free ore has been struck at 20 to 35 ft. The ore is thin but high grade and shows no trace of the bitumen that is in the ore at Miami. Some iron is in the ore.

Pennsylvania

ANTHRACITE COAL

Sterrick Creek Colliery—The new breaker, replacing the old one recently destroyed by fire, is nearing completion and will be in operation by Nov. 1. It is near Scranton and has a capacity of 1700 tons daily.

BITUMINOUS COAL

Monongahela River Consolidated Coal and Coke Company—The financial statement for the nine months of the fiscal year from Nov. 1 to July 31, shows earnings over working expenses of $1,475,469. Coal royalties were $384,108; depreciation, $307,781; taxes, $112,500; interest, $350,607; insurance funds, $207,876; total charges $1,362,872. This leaves a surplus of $112,597; a decrease of $148,222 from last year.

South Dakota

Gild Edge Maid—This company, at Deadwood, will have the mill repaired by Sept. 15. The capacity will be 250 tons daily. J. S. Ford is manager.

Magpie—A Pittsburg company is figuring on starting dredging operations on this placer property on Rapid creek.

Utah

Juab County

Beck Tunnel—It is reported that this property now closed will soon be operated by leasers.

May Day—Arrangements are being made to resume development on company account. There are 11 sets of leasers, all of which have ore. Those on or near the 1000-ft. level have such a good showing that the company will start work on the 1100 east of the shaft to catch the ore at this level. About 200 ft. of drifting will be necessary to reach the point where it is looked for. Between 2½ and 3 ft. of good ore was opened above. The company has not been doing any underground work recently, but is milling some of the large dumps, and shipping from two to three cars of concentrates a month.

Carisa—No work is being done by the company, but several sets of leasers are making shipments.

Mammoth—Ore has been followed to the 2260-ft. level.

Victoria—Good progress is being made in sinking the shaft, which is done under contract. The 700-ft. level has been reached.

Opex—The company is trying to find whether or not the orebody encountered by drilling in Centennial-Eureka territory enters the Opex lines. It is thought that the ore may make out into the limestone bedding south of the main break.

Chief Consolidated—The drift south on the 1400-ft. level has cut 10 ft. of silicious ore carrying gold and silver. In Eureka City ground 600 ft. north of this discovery a new oreshoot was recenly opened in a raise 50 ft. above the 1400. This ore is of the same character. Work has been somewhat restricted by the capacity of the hoisting equipment, and operations have been reduced to two shifts. Shipments up to date are 118 car lots, the returns from which have practically met expenses.

Yankee—The shaft broke into a large cave at about 950 ft. The cave is 300 ft. long, and varies from 25 to 35 ft. in hight and width. Sinking will be continued. No ore was found here.

Eagle & Blue Bell—The installation of the new hoist has been completed. It was given a tryout Aug. 27, and found to be in good working order. Work in sinking the shaft will be pushed. The raise from the 100-ft. level is up 180 ft., and 40 ft. of this is in low-grade ore.

Utah Consolidated—A cave was broken into recently in driving the new tunnel. It is 15 ft. or more deep, but the lateral extent is not known.

Gold Chain—The compressor plant which is to be used jointly with the Opohongo is being installed on the site of the Sioux mill at Robinson. Two 250-h.p. boilers that belonged to the mill will be used. Air will be furnished for 15 drills. Work is being done on the 100-, 300- and 400-ft. levels, and some ore running between $30 and $35 is being mined.

Salt Lake County

Utah Copper—A part of the Copperton mill equipment will be installed in the Arthur plant at Garfield. Work of remodeling this mill will be started soon. The Boston Consolidated company is now liquidated. Production for July is reported as 8,677,851 pounds.

Bingham Mines—On account of the closing of the Yampa, this company has made a new contract, by which copper ores from the Commercial and Dalton & Lark mines will be shipped to Garfield. and the lead-silver ores from the latter mine will be sent to Murray.

Samson—At a stockholders' meeting July 1, it was decided to put the company out of existence. Most of the stock is owned by the Bingham Mines Company, and the property will be absorbed by the latter.

Utah Leasing—Excavating for the new cyanide plant was started Aug. 29.

Silver Shield—According to a statement by Manager Josephs, the recent assessment of 1½c. a share was necessary in order to reduce the company indebtedness, as demanded by the bank, and to continue development.

Ohio Copper—Word has been received at the local offices to proceed with the plans for completing the mill. Specifications for new machinery have been sent East.

Baby McKee—Control of this property in Big Cottonwood, which was held by Chicago interests has been taken over by Congressman Joseph Howell and his son.

Columbus Consolidated—New ore is reported on the 300- and 400-ft. levels.

South Columbus—A strong opposition to the merger with the Alta-Hecla company is being framed, and there is doubt of the consolidation being effected at the special meeting Sept. 5.

Columbus Extension—A 10-ft. face of ore is reported in the workings on the main tunnel-level. This was exposed after the heavy flow of water recently encountered had ceased. The ore carries silver and copper.

Summit County

American Flag—Colorado interests are negotiating for a lease and purchase of a block of treasury stock. F. V. Bodfish, of Cripple Creek is examining the property.

Daly-Judge—No trouble has been experienced in keeping the 1600-ft. level free from water, and cleaning up and development is under way. About 1000 ft. of work was done on this level before it became inaccessible. The drift along the big fissure is caved. The present work is in the Ontario quartzite.

Daly West—The company is employing 150 men underground, and 80 in the mill.

Silver King Coalition—The electric haulage system on the 1300-ft. level is being installed. A new find of ore between the 1200 and 1300 levels is reported.

Wyoming

In the Sundance district, Crook county, the Bear Lodge company, L. R. Davis in charge, is sinking 150 ft. deep and will install a hoist. The Warren Peak company is driving a tunnel, the Reuter company is making cyanide tests of its ore, and will install a compressor and drive a tunnel. In the western part of the district John Belshe is driving a 300-ft. tunnel and Thomas Whitman is sinking. The Copper Prince has opened a copper vein with gold. The ores of the district are chiefly gold bearing.

Canada

Alberta

Durham Collieries, Ltd.—This company controls 6700 acres of coal lands 36 miles north of Lethbridge. The stock is owned chiefly by people in Spokane and Colfax, Wash. It is announced that arrrangements have been made for money to open mines, and that work will be begun soon.

Ontario

Shipments from Cobalt for the week ended Aug. 26 were as follows: Buffalo, 59,240 lb.; City of Cobalt, 60,140; Cobalt Townsite, 66,000; Crown Reserve, 181,090; Kerr Lake, 480,000; La Rose, 170,320; McKinley-Darragh, 180,260; Nipissing, 445,340; Right of Way, 111,420; Temiskaming, 120,000; total, 1,873,810 pounds.

Ophir—A new vein struck at the 285-ft. level of this Cobalt property in putting down the main shaft to 300 ft. shows a width of 12 in. It is niccolite carrying ruby silver and argentite.

Green-Meehan—This Cobalt mine which has been closed for some time has been leased for five years to E. C. Kingswell, of Ottawa, and associates and it is understood that a large force will be put at work at once. The lessees agree to expend $30,000 in developing.

Black Mines Consolidated—At a meeting of shareholders in Montreal, Aug. 30, it was resolved to authorize the directors to pledge the assets of this Cobalt company as security for a loan of $25,000 needed to continue work.

Beaver—Two good discoveries have recently been made at this Cobalt mine. An oreshoot on the 200-ft. level, supposed to have been worked out, has widened to 14 in. high-grade ore, running about 5000 oz. to the ton. A raise is being put on the shoot. On the 300-ft. level another rich oreshoot, 3 in. wide, has been encountered.

Temiskaming—A nugget of almost pure silver weighing 1200 lb. was taken from below the 400-ft. level. This property has been making exceptional progress the last six months.

Ophir—A 12-in. vein carrying silver has been cut at the 285-ft. level. This property is in the same formation as the Temiskaming and is close to it.

Beaver—Two new high-grade veins have been discovered on the 200- and 300-ft. levels respectively. A shipment will shortly be made.

Crown Reserve—Recent developments show conditions much improved at this mine. The drift on the Victoria vein has run through a few feet of poor ore and is again working in high-grade ore. The latest find down the lake is showing up exceptionally well.

Buffalo—The mill report for July shows that 3398 tons averaging 33¾ oz. were treated, and that 88,078 oz. were recovered. Milling expenses amounted to $3945.

O'Connor—These silver mines, near Latchford, will install a plant.

Hylands—A two-stamp mill is to be ordered for this property at Porcupine.

Crown Gas and Oil Company, Limited—This Ottawa company has just completed a big sale of leases of oil lands in western Ontario, covering about 10,000 acres, to the Standard Oil Company, of Canada, an English corporation, for $400,000 in cash and shares. The latter company has made plans for the development of the properties on an extensive scale, including the sinking of ten wells.

Mexico

CHIHUAHUA

Plomosas—The remodeled concentration plant at this zinc mine has been put in commission by the new owners, Compañia Minera las Plomosas, a French-Mexican company, of which C. Clerc is active manager. The property is in the eastern part of the State in the Picachos district.

Urique—The Urique Mining and Smelting Company has been organized at El Paso for the acquisition and operation of several old mines in the Urique section, western Chihuahua.

Rio Plata—The July bullion production was 82,000 oz., the largest monthly production to date. An August bullion shipment consisted of 52 bars silver of value of 52,000 pesos.

Refugio—This Parral property has passed into the hands of J. F. Moffett and associates, of Boston, who are planning on immediately putting the property on production list. The deeper levels will be unwatered and the old mill will either be partly or entirely dismantled to make way for another reduction plant. The manager is James E. Hislop.

Virgen—This gold property, owned by Luis Terrazas, Jr., of Chihuahua, in the eastern part of the State will be shortly equipped with a small amalgamation and cyanide plant will be added later. R. Perez is in charge.

Rio Tinto—Owing to delay in receipt of machinery this company's remodelled and enlarged smeltery, at Terrazas, will not be ready for blowing until October. A second furnace and converters have been added. R. B. Hutchinson is the manager.

Calabacillas—This old gold-silver mine in the extreme western part of the State and accessible from El Fuerte, Sinaloa, has lately been acquired by Americans who will carry on extensive operations, including the building of a large cyanide plant.

Palmilla—The first 250-ton unit of this cyanide plant at Parral will be in readiness for operation early in October and work on the second unit of like capacity will be started shortly after. James I. Long is the president and manager.

Concheno—Cyaniding operations were lately resumed at this property in the Ocampo section. Tailings as well as mine ore are being treated.

Exploration Company of London & Mexico—In addition to acquiring the Buena Tierra mine in the Santa Eulalia camp and the Princessa property in the Cusihuiriachic camp, this company is making examinations of a number of properties in the western part of the State. The consulting engineer, R. W. Raymond, is spending considerable time in the State and recently visited gold properties in the Dolores camp. The resident engineer, L. Maurice Cockerell is also in the field with a corps of assistants.

Boston-Mexican Development Company—D. C. Sutton, manager of this company, reports good progress at the several properties in the Sabinal camp. Additional machinery is planned.

Encinillas—It is again reported that the company will enlarge its Santa Rosalia smeltery and resume. J. L. St. Dizier, the manager, has lately returned from Paris in consultation with the French stockholders.

Mexico Consolidated—The company will not be reorganized, but will issue $350,000 of notes to pay off its floating debt and provide $50,000 working capital. The company has run out of its high-grade ore and is now a milling proposition, but needs development.

Alvarado Consolidated—It is probable the company will be consolidated with the Palmilla Milling Company.

DURANGO

Durango-Canadian Tin Company—This company has been organized in British Columbia, capital $2,000,000 to operate a tin concession in Durango. Roy Smith, of Bisbee, Ariz., is manager.

GUANAJUATO

San Cayetano—Between 400 and 500 men are on the work at San Cayetano, where the unwatering of the famous Mexamora property was accomplished some months ago. Large gangs are busily engaged in developing there and in timbering both there and in the Puertecito properties. F. H. Clark is manager.

Santa Natalia—The mill has installed a semi-continuous slime treatment that is giving high etraction on Guanájuato ore. Ore is being bought, but the main supply of 30 tons per day is being obtained from the Santa Natalia mine. The mill is in charge of Cooper Shapley.

Guanajuato Consolidated—The quarterly returns and working charges for May, June and July are: Mill ran 86½ days; ore crushed, 23,145 tons; concentrates shipped, 435 tons; bullion, 174,918 pesos; concentrates, 127,278 pesos; total gross value, 302,197 pesos; working expenses, including marketing of bullion, concentrates, treatment, etc., 224,951 pesos; profit, 77,246 pesos; expended on development, out of profit, 42,659 pesos; development work, 1139 ft. During the three months 1139 ft. of development was done, one-half was driven on the ninth and 10th levels, the San Francisco orebody has been drifted on 103 ft., in good milling ore; but only one crosscut has been driven to determine its full width. In this the ore formation is 75 ft. wide, and averages about 15 pesos per ton. The crosscut from the main 10th level reached the San Francisco orebody about June 1, and at the point of intersection drifts north and south were started, which have exposed 138 ft. of 15 pesos ore. No crosscutting has been done to determine the width. Joseph MacDonald is general manager.

GUERRERO

Rosario—A British company known as the Taxco Mines of Mexico, Ltd. T. R. Marshall at the head has acquired this group at Taxco and will develop and explore.

Cedral-Laguela—A Boston Company has been formed to operate these Taxco mines. The company has a capital of $1,250,000, Eugene M. Foss is president. A 500-ton mill is planned.

MEXICO

El Buen Dispacho—Pichon, Durand & Co. of Paris, have an option on this El Oro property and will sink a new shaft.

SAN LUIS POTOSI

A "gusher" was brought in at 2300 ft. at Ebano oilfields Aug. 14 by the Huasteca Petroleum Company. The flow is about 10,000 bbl. daily.

THE MARKETS

Current Prices of Metal, Minerals, Coal and Stocks, Conditions and Commercial Statistics

Coal Trade Review

New York, Sept. 7—In the East trade has been quiet, both anthracite and bituminous. The only feature is the development of a car shortage, which may become serious later.

In the West interest still centers on the strike situation, notes on which are given below. The week has been an interesting one, since it may fairly be said that more progress has been made toward settlement of the disputes in Illinois and the Southwest than in two months previously. That the end of both troubles is now fairly in sight seems to be a safe prediction today.

Western Strike Conditions—The operators in the Irwin district in Pennsylvania have attempted to force a settlement of the protracted strike there by causing the arrest of a number of the leaders on charges of conspiracy and inciting to riot and destruction of property. The trial of these cases will involve some important disputed legal points. The underlying cause of this strike was the refusal of the operators to recognize the union.

In the Southwestern district a new proposition made by the operators was submitted to a convention of the miners' representatives held at Pittsburg, Kan. The operators are now willing to grant the increase in wages demanded by the Cincinnati convention. In return, however, the operators demand that the men shall permit the insertion in the contract of a clause that will call for the continuation of work pending the negotiation of a wage scale, and clauses providing for the penalizing of the miners for a breach of contract, and also for the selection of an umpire to settle disputes. The compromise was accepted, and work will be resumed at once.

In Illinois a conference, which it is hoped will be final, is now in session at Chicago. Miners and operators alike are tired of the strike, and a compromise will probably be arranged.

Coal Traffic Notes

Coal shipments down Great Kanawha river in West Virginia, six months ended June 30, were 775,736 tons in 1909, and 735,800 in 1910; decrease, 39,936 tons.

Anthracite-coal tonnage of Baltimore & Ohio railroad, six months ended June 30, was 418,924 tons in 1909, and 453,816 in 1910; increase, 34,892 tons.

Coal receipts at St. Louis, six months ended June 30, were 3,099,828 short tons in 1909, and 3,921,551 in 1910; increase, 821,277 tons.

Coal tonnage of Monongahela River Consolidated Coal and Coke Company, nine months of fiscal year from Nov. 1 to July 31, short tons:

	1909.	1910.	Changes.
River coal	3,719,995	3,620,167	D. 99,828
Rail coal	714,705	1,875,839	I. 1,161,134
Total	4,434,700	5,496,006	I. 1,061,306

The total increase this year was 23.9 per cent., entirely in rail shipments.

Coal shipments over the Norfolk & Western railway in July, short tons:

Field:	Commercial.	Company.	Total.
Pocahontas	917,738	85,240	1,002,978
Tug River	127,470	38,551	166,021
Thacker	139,163	50,283	189,446
Kenova	51,705	12,682	64,387
Clinch Valley	66,278	4,178	70,456
Total	1,302,354	190,934	1,493,288

July is the first month of the company's fiscal year.

Coal and coke tonnage of Chesapeake & Ohio railway, fiscal year ended June 30, 1910, short tons:

	Coal.	Coke.	Total.
New River	7,686,064	359,750	8,045,814
Kanawha	6,714,298	62,461	6,776,759
Kentucky	584,918	228	585,146
Connecting lines	96,957	45,301	142,258
Total	15,082,237	467,740	15,549,977
Total, 1908-9	12,406,928	388,858	12,795,786

Total increase for the year, 2,754,191 tons, or 21.5 per cent.

New York

Anthracite

Sept. 7—The market shows a fair degree of activity, especially for steam coals.

Schedule prices for large sizes, $4.75 for broken and $5 for egg, stove and chestnut, f.o.b. New York harbor. For steam sizes, current quotations are: Pea, $2.95@3.25; buckwheat, $2.15@2.50; No. 2 buckwheat, or rice, $1.65@2; barley, $1.35@1.50; all according to quality, f.o.b. New York harbor.

Bituminous

There is no material change in trade, which remains rather dull, especially for the better grades of steam coal. All-rail trade, however, is looking up a little. Transportation is inclined to be slow, and complaints about car supply are heard on some lines. Prices are unchanged.

In the coastwise trade vessels are to be had without trouble. Rates are unchanged, on rather a low basis. Vessel owners are looking forward for a better demand toward the close of the month.

Birmingham

Sept. 5—Coal operators in Alabama continue active. Coal is being shipped from the Alabama mines as quickly as it can be handled by the railroads. There is a little car shortage on some lines but this is not extensive. The moving of cotton will soon start in and coal operators are apprehensive that cars will be diverted from the coal trade.

The Tennessee company is pushing the work of sinking the shaft at No. 13 mine, in the western part of the Birmingham district.

Reports of extensive deals in coal lands in this State are current.

Chicago

Sept. 5—The demand for stocks of bituminous coal has been large in the last week, yet the buying movement at advancing prices has received a check in the newspaper announcements that a settlement of the labor troubles at Illinois mines is near. Even with supplies again coming in freely from those mines, however, the deficiency in stocks is so great that it will be several weeks at least before a normal condition is restored in the trade. This is seen by many dealers and users of coal; consequently, buying is still on a basis of high prices. Indiana and southern Illinois lump brings $2.50@2.75, run-of-mine $2.25@2.50 and screenings $2.20@2.40, in car lots. Eastern coals are somewhat quiet as a result of the September advances but the demand is expected to continue large and steady. Anthracite is dull and is not expected to revive before the beginning of cold weather.

Cleveland

Sept. 5—Lake trade is quiet, and comparatively little coal is going forward. Vessels have trouble in getting cargoes. The light Lake shipments have caused a scarcity of slack. Domestic coal is going well, consumers being disposed to put in stocks early.

Middle district coal is quoted, f.o.b. Cleveland, at $2.15 for 1¼-in., $1.90 for ¾-in. and $1.80 for run-of-mine. No. 8 and Cambridge districts, 5 to 10c. higher. Owing to the scarcity of slack, premiums have been paid. Nominal quotations are $1.55@1.60, but $1.75 and up to $1.90 have been paid.

Indianapolis

Sept. 5—Although there is an unusual demand for Indiana domestic coal, due to strike causes, there was not the formal

advance in price that is made Sept. 1 each year, because prices depend on amounts bid for coal. A large majority of Indiana operators have been refusing orders for a week at any price, that they may catch up with orders on hand.

Steam coal is selling at $1.60 a ton, an increase of 10c. a ton for a few days past, and the market is strong at that price, indicating that the price may go to $1.70. The scarcity of river coal at the docks on the Ohio is another cause stimulating the price of steam coal. A large amount of eastern steam coal is now coming west and this will likely cause Indiana coal to be in less lemand.

Pittsburg

Sept. 6—Local demand for coal has shown no improvement with the close of the midsummer period, but is of as good volume as during August. Shipments in the Lake trade are decreasing slightly, owing to heavy supplies in the Northwest. The mines are not running as fully, and production is more closely adjusted to requirements, thus eliminating the extreme cutting which has been done from the nominal price; as a rule the cutting does not go beyond 2½c. on mine-run and lump. We quote: Mine-run and nut, $1.20@1.22½c.; ¾-in., $1.30@1.32½; domestic 1¼-in. lump, $1.45@1.47½; slack, 75@82½c. per ton.

Connellsville Coke—A merchant furnace interest which was in the market for about 20,000 tons for September has completed its purchases, practically all the tonnage being at $1.60. The Whitney-Kemmerer Company, a middle interest in Pittsburg, is reported to have purchased the full output of the Dunlap Connellsville Coke Company from Sept. 1 to July 1, amounting to 2000 or 3000 tons monthly. On the whole the market has been quiet. We continue to quote standard grades of Connellsville coke per net ton: Prompt furnace, $1.60@1.65; contract furnace (nominal) $1.75@1.85; prompt foundry, $2.10@2.25; contract foundry, $2.25@2.50, all at ovens.

The *Courier* reports the production in the week ending Aug. 27 at 361,913 tons, a decrease of 4000 tons, and shipments at 3958 cars to Pittsburg, 5335 cars to points west and 982 cars to points east, a total of 10,275 cars.

St. Louis

Sept. 5—The market this week remains practically the same as it was a week ago today. The advancing tendency has been checked by the fact that the Illinois miners and operators are in session now at Chicago trying to patch up the differences in the Springfield and Carterville districts. Buyers have consequently been holding off until the outcome of the conference is known and consequently the market has remained stationary. A few operators in the Standard district seem to be a little week-kneed and offered to sell coal for future delivery at slightly under the market price; however, about 80 per cent. of the tonnage of the field has been bought up for the month of September and consequently such a small portion of coal is on the market that there is no logical reason why the price should go off, in spite of the fact that the Carterville district may resume operations. Even if the scale should be signed at once it will take several weeks before the district as a whole will be able to produce any considerable tonnage, and practically the entire amount, with the exception of perhaps screenings, would move to the northwest.

The anthracite market is in unusually good condition. All sizes are moving freely. There has not been a car up to demurrage for over a month. The demand for grate is suprising as it is generally a slow seller at this time of the year. Chestnut is scarce, though it seems to be coming forward in liberal quantities.

Current prices are as follows for the St. Louis market:

	Mine.	St. Louis.
Illinois, Standard:		
6-in. lump and egg	$2.00	$2.52
2-in. lump	1.85	2.37
Mine-run	1.60	2.12
Screenings	1.20	1.72
Trenton:		
6-in. lump and egg	2.50	3.02
3-in. nut	2.00	2.52
Staunton or Mt. Olive:		
6-in. lump	2.00	2.52
2-in. nut	1.60	2.12
Mine-run	1.65	2.17
Screenings	1.50	2.02
Carterville:		
6-in. lump or egg	2.00	2.67
3-in. nut	2.00	2.67
Mine-run	1.60	2.07
Screenings	1.25	1.92
Pocahontas and New River:		
Lump or egg	1.90	4.40
Mine-run	1.55	4.00
Pennsylvania Anthracite:		
Nut, stove or egg	.....	6.95
Grate	.....	6.70
Arkansas Anthracite:		
Egg or Grate	2.35	5.35
Coke:		
Connellsville foundry	.....	5.40
Gas house	.....	4.90
Smithing	.....	4.15

East St. Louis, Ill., prices are 20c. per ton less than St. Louis prices on soft coal.

FOREIGN·COAL·TRADE

United States Coal Exports—Exports of coal and coke from the United States, with coal furnished to steamships in foreign trade, seven months ended July 31, long tons:

	1909.	1910.	Changes.
Anthracite	1,709,401	1,769,825	I. 60,424
Bituminous	4,915,914	5,733,302	I. 817,388
Total exports	6,625,315	7,503,127	I. 877,812
Steamer coal	3,538,221	3,760,548	I. 222,327
Total	10,163,536	11,263,675	I. 1,100,139
Coke	547,434	508,859	D. 38,575

Canada took this year 5,505,267 tons of coal, or 73.4 per cent. of the total exports. Cuba took 481,527 tons of coal. The coke went chiefly to Mexico and Canada.

United States Coal Imports—Imports of coal and coke into the United States, seven months ended July 31, long tons:

	1909.	1910.	Changes.
Anthracite	3,125	162	D. 2,963
Bituminous	636,939	1,081,609	I. 444,670
Total coal	640,064	1,081,771	I. 441,707
Coke	111,065	65,181	D. 45,884

Canada furnished this year 922,471 tons of coal and nearly all the coke; Australia, 101,593 tons of coal; Japan, 50,780 tons of coal. Imports are chiefly on the Pacific Coast and in the far northwestern States.

IRON·TRADE·REVIEW

New York, Sept. 7—While no great changes from last week can be reported, the more cheerful tone in the iron and steel markets is evident, and better business reports come from nearly all quarters. There is more readiness manifest to contract for future deliveries and a disposition to increase commitments which has not been shown for some months past.

In pig iron more orders for foundry iron have been placed in Eastern territory, and large consumers are inquiring for supplies running into next year. In the Central West foundry and basic pig are being inquired for in a way which seems to mean business. The South is rather lagging behind.

In finished material also there have been more sales and many inquiries. Wire jobbers are disposed to take on pretty liberal stocks. Structural steel continues to lead, and small orders are coming in freely, with some larger ones pending. Specifications on contracts are coming in better than they have been for some time.

A good export trade is reported, including an order for 7000 tons of rails for Korea. The Quebec bridge letting has been postponed until October.

Baltimore

Sept. 5—Imports for the week included 2270 tons ferromanganese from Liverpool; 6174 tons iron pyrites from Huelva, Spain; 28,050 tons iron ore from Cuba. Exports included 116,414 lb. zinc dross to Liverpool.

Birmingham

Sept. 5—The new month started with a decidedly better feeling in the Southern pig-iron market. The demand shows a slight improvement and there is some inquiry that promises to result in business. Some large interests have been sounding the Southern market, and sales of low-grade iron in quantity are probable for the near future. The cast-iron pipe interests are said to be in need of iron. Southern manufacturers deny that any iron is being sold under $11.50 per ton, No. 2 foundry, despite the positive statements that come from other places that some

business has been placed in the Southern market at $11 and a little over. The probable make for the present month is reported to have been sold ahead.

The cast-iron pipe makers in Southern territory are shipping their product faster than they are making it, which means that yards will, in a short time, be depleted of accumulated stock.

Chicago

Sept. 5—The iron market shows signs of briskness near at hand. In the last week sales and inquiries for all kinds of iron have increased, largely stimulated, perhaps, by the 40,000 ton purchase by the Oliver plow interests. Yet the average melter of foundry iron, whose purchases really determine this market, is still holding off from liberal buying. Prices hold to $11@11.50 Birmingham ($15.35@15.85 Chicago) for Southern No. 2, and $16.50@17 for Northern No. 2. An increasing tonnage is being booked for 1911, yet the main interest of the trade is in last-quarter deliveries, with many melters seeking lower quotations on the first-quarter than the furnace representatives are willing to give. Iron and steel products are finding in general somewhat better sale, though the aggregate is still light. Coke is steady at $4.85 Chicago.

Cleveland

Sept. 5—Ore shipments seem to be dropping off, and vessel movements are slower. Furnaces are not taking ore from the docks freely, and shippers are disposed to go slow.

Pig Iron—A number of inquiries are reported for foundry iron and some for basic. Furnaces are rather holding back on contracts running into next year, though willing enough to take fourth-quarter business at going prices. Bessemer pig is quoted at $15.90, Cleveland; No. 2 foundry, $14.50@14.75; forge, around $14. M. A. Hanna & Co., Cleveland, secured a good share of the Oliver Plow Company order, the biggest placed for some time.

Finished Material—There is not much to report. Some bridge and building contracts are pending, but not yet awarded. Sheet business is demoralized, and there is plenty of cutting.

Philadelphia

Sept. 7—Inquiries from foundry-iron consumers first presented early in August resulted in the placing of a few small orders this week with the stipulation in two or three cases that the orders could be extended within 30 days for as much more as the customers might want. Buyers appear to recognize that prices are at their lowest. Makers do not fear any further shading in Southern irons in this territory. It is known that stocks are very low in this and New England territory. Each day brings more inquiries and a fair monthly business is in sight. No. 2 X foundry clings to $16; gray forge, Northern, $15; Southern, $14.50; basic, $15 per ton.

Steel Billets—Last deliveries on late spring orders have been made and supplies in some localities are near the vanishing point.

Bars—The prospects are that there will be a slacking up of orders from car shops. Bar-iron makers are soliciting business from the larger buyers without much success. The retail mill demand shows little improvement. No further shadings have been made.

Sheets—The market shows signs of dullness. Some sharp cutting in quotations has been quietly going on.

Pittsburg

Sept. 6—A slight further improvement is reported in specifications and inquiries for finished steel products, and there is a more hopeful feeling. At best, however, the improvement is no more than should be looked for at this season, with the midsummer vacation period passed, and basic conditions do not seem to have improved. Prices have not strengthened at any point, but there have been no distinct declines in the week and on the whole prices are holding better than might be expected in the circumstances.

Pig Iron—Sales of pig iron have been much lighter in the past week than in the preceding week. There is a fair inquiry for small lots of iron, particularly foundry grades, but nothing really heavy. We continue to quote f.o.b. Valley furnaces 90c. higher delivered Pittsburg; Bessemer, $15; basic, $13.75; No. 2 foundry, $14@14.25; forge, $13.35; malleable, $14.50 per ton.

Steel—Reports are better as to specifications. There is moderate inquiry. Occasional reports of particularly low prices are not credited, and the market remains quotable, f.o.b. maker's mill, Pittsburg or Youngstown: Bessemer billets, $24.50; sheet bars, $25.50@26; open-hearth billets, $26; sheet bars, $26.50@27; rods, $28@29; forging billets, $29.50@30 per ton.

Ferromanganese—The market has shown no improvement since the gain reported last week and on the whole is comparatively quiet. We continue to quote prompt at $39.25@39.50 and forward at $40, f.o.b. Baltimore, freight to Pittsburg being $1.95 per ton.

Sheets—Demand for sheets has shown some improvement, and is fairly heavy, but purchases are confined to immediate requirements: Concessions remain as last noted, about $4 a ton on black, $5 on galvanized and $1 on blue annealed, nominal prices being: Black, 2.40c.; galvanized, 3.50c.; painted corrugated, $1.70; galvanized corrugated, $3; blue annealed, 1.70c. for 10 gage.

St. Louis

Sept. 5—The pig-iron market remains dull, though some think that a slight improvement has been noted. Sales agents report that inquiries seem to be coming in more freely, though the actual amount of business closed has been light. There is no change in price from $11.50 Birmingham or $15.25 f.o.b. St Louis.

FOREIGN IRON TRADE

Canadian Iron—The make of pig iron in Canada for the half-year ended June 30 is reported by the American Iron and Steel Association as below, in long tons:

	1909.	1910.	Changes.
Foundry and forge..	84,890	81,079	D. 3,811
Bessemer.....	99,639	129,208	I. 29,569
Basic.....	165,112	165,984	I. 872
Total.....	349,641	376,271	I. 26,630

The increase over the second half of 1909 was 48,822 tons. There were 14 furnaces in blast. Of the total in 1910 there were 7415 tons made with charcoal and a few tons by electricity.

METAL MARKETS

New York, Sept. 7—The metal markets generally have been fairly active, and some signs of improvement in demand and prices are manifest in several directions.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
July 1910..	$ 828,451	$10,282,649	Imp.$ 9,454,198
" 1909..	16,661,782	3,269,886	Exp. 13,391,896
Year 1910..	50,345,182	29,671,180	" 20,674,002
" 1909..	80,496,119	23,405,478	" 57,090,641
Silver:			
July 1910..	5,124,471	3,794,888	Exp. 1,329,583
" 1909..	5,049,366	3,916,117	" 1,133,249
Year 1910..	32,178,689	25,696,408	" 6,482,281
" 1909..	34,409,032	26,788,145	" 7,620,887

Exports from the port of New York, week ended Sept. 3: Gold, $150,200, chiefly to Panama; silver, $1,144,568, chiefly to London. Imports: Gold, $74,790; silver, $145,681, from Mexico and South America principally.

Exports of silver from London to the East from Jan. 1 to Aug. 25, reported by Messrs. Pixley & Abell:

	1909.	1910.	Changes.
India.....	£4,278,500	£4,142,500	D. £ 136,000
China.....	1,555,200	1,113,500	D. 441,700
Straits.....	82,800	.....	D. 82,800
Total.....	£5,916,500	£5,256,000	D. £ 660,500

India Council bills, in London brought an average of 16.01d. per rupee for the week.

Gold—Prices on the open market in London were unchanged at 77s. 9d. per oz. for bars, and 76s. 5d. per oz. for American coin. Most supplies were taken by the Bank of England. In New York about $950,000 in coin was taken for Canada.

Platinum—The market remains quiet, and prices are unchanged at $33 per oz. for refined platinum and $37.50@38 per oz. for hard metal.

SILVER AND STERLING EXCHANGE

Sept.	1	2	3	5	6	7
New York....	52⅞	52⅞	52¾	.....	52⅞	52⅞
London	24⅝	24⅜	24 7/16	24 7/16	24⅜	24⅝
Sterling Ex..	4.8630	4.8635	4.8635	.....	4.8615	4.8610

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Silver—The market for silver continues steady without feature. Prospects of large and bountiful crops in India are favorable, and the possibilities are, silver will not see much decline this autumn.

Copper, Tin, Lead and Zinc

Sept.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. New York, Cts. per lb.	Zinc. St. Louis. Cts. per lb.
1	12½@12⅝	12.50@12.55	35⅝	4.40	4.27½@4.32½	5.37½@5.42½	5.22½@5.27½
2	12⅝@12⅝	12.50@12.55	35¼	4.40	4.27½@4.32½	5.37½@5.42½	5.22½@5.27½
3	12⅝@12⅝	12.50@12.55	35¼	4.40	4.27½@4.32½	5.37½@5.42½	5.22½@5.27½
5	.....	.....	.....	.....	.....	.....	.....
6	12⅝@12⅝	12.50@12.55	35¾	4.40	4.27½@4.32½	5.40@5.45	5.25@5 30
7	12⅝@12⅝	12.50@12.55	36⅛	4.40	4.27½@4.32½	5.42½@5.45	5.27½@5.30

The New York quotations for electrolytic copper are for cakes, ingots and wirebars, and represent the bulk of the transactions made with consumers, basis New York, cash. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

DAILY PRICES OF METALS IN LONDON.

Sept.	Copper. Spot.	Copper. 3 Mos	Tin. Spot.	Tin. 3 Mos	Lead. Spanish.	Lead. English.	Zinc, Ordinaries.
1	55⅝	56 7/16	163½	158¼	12½	12⅝	22¾
2	55⅞	56¼	161½	157	12½	12⅝	22¾
3	.....	.....	.....	.....	.....	.....	.....
5	55½	56⅜	162¾	157¾	12½	12⅝	22¾
6	55 15/16	56⅜	164½	158	12 7/16	12⅝	22⅞
7	55 15/16	56 5/16	166	157⅝	12½	12⅝	22⅞

Closing quotations on London Metal Exchange. All prices are in pounds sterling per long ton, 2240 lb. Copper quotations are for standard copper.

Copper—During the last week the market has been characterized by great dullness, transactions having been smaller than for a long time, owing in part, perhaps, to the triple holiday. However, European consumers are constantly in the market, buying fair-sized quantities. Inquiry from domestic consumers has been small. Electrolytic continues to be offered by all of the agencies at 12¾c., delivered, 30 days, corresponding to about 12.60c., cash New York, for domestic business. This price has been shaded by a few points, but there is absolutely no pressure to sell, the producers being well booked ahead and satisfied as to the statistical position, expecting a stronger market. As in the previous week orders for foreign delivery have been accepted on slightly lower terms than for domestic, and also a difference of a few points has been made according to the time of shipment on all business. Lake copper has been decidedly stagnant and it has been possible to purchase this metal advantageously, at least in small quantities. The close is steady at 12⅝@12⅞c. for Lake copper, and 12.50@12.55c. for electrolytic copper in cakes, wirebars and ingots. Casting copper is quoted nominally at 12¼@12½ cents.

Copper sheets are 18@19c. base for large lots. Full extras are charged, and higher prices for small quantities. Copper wire is 14c. base, carload lots at mill.

The increase in statistics abroad of 800 tons reported the beginning of this month had a weakening influence on the standard market, and induced holders to realize on their stocks. At the lower level, quotations remained steady and the close is cabled at £55 11s. 3d. for spot, and £56 6s. 3d. for three months.

Refined and manufactured sorts we quote: English tough, £58; best selected, £59 10s.@£60; strong sheets, £67 10s.@£68 10s. per ton.

Exports of copper from New York for the week were 5300 long tons. Our special correspondent gives the exports from Baltimore for the week at 46 tons.

Tin—The London market is an entirely artificial one. Spot supplies are cornered and selling at this writing at about £8 per ton over three months tin. Under such conditions it is impossible to gage the future of the market correctly, and one guess is as good as another. Prices have advanced as much as £3 from one day to another, and were not at all influenced by the published statistics, which showed an increase of about 500 tons in the visible supplies over last month. The close is cabled at £166 for spot, and £157 15s. for three months.

Business among dealers was quite active in the domestic market. Consumers, however, are wisely holding aloof and buy only when they are forced so to do by their necessities. At the close, September tin is quoted at about 36⅛cents.

Lead—There is a satisfactory inquiry on the part of consumers. Their wants, however, are being freely supplied at unchanged quotations of 4.40c. at New York, and 4.27½@4.32½c. at St. Louis.

The London market is reported as being active. The close is steady at £12 10s. for Spanish lead, and £12, 12s 6d. for English lead.

Spelter—During the last week a rather heavy business has been transacted, sales up to Saturday having been effected on the basis of 5.25c. St. Louis, and since the holiday at an advance. The statistical position of this metal seems to be good, and also the demand from consumers, and the outlook is regarded as favorable for a further advance. The market closes strong at 5.27½@5.30c. St. Louis, and 5.42½@5.45c. New York.

The foreign market is also extremely firm and a large consumption is reported. The London quotation for good ordinaries is cabled at the close at £22 17s. 6d. and specials at £23 2s. 6d. per ton.

Base price of zinc sheets is $7.50 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8 per cent. discount.

Other Metals

Aluminum—The set-back in the automobile industry has been keenly felt in this metal, and during the last week ingot has been freely offered at 22c. per lb., while it has been possible to effect business at a concession from that figure. We quote 21½@22c. for No. 1 ingots.

Antimony—Business continues light. Prices are nominally unchanged at 8¼@8⅜c. per lb. for Cookson's; 7⅞@8c. for U. S., and 7¼@7⅜c. for outside brands.

Quicksilver—The market is steady. In New York, quotations are unchanged at $46 per flask of 75 lb. for large lots; $47@48 for jobbing orders. San Francisco, $45.50 for domestic orders and $2 less for export. The London price is £8 12s. 6d. per flask, with £8 6s. 3d. quoted by second hands.

Cadmium—Current quotations are 60@70c. per lb. in 100-lb. lots, f.o.b. New York, according to quality of metal.

Imports and Exports of Metals

Exports and imports of metals in the United States, seven months ended July 31, are reported as follows, in the measures usual in the trade:

Metals:	Exports.	Imports.	Excess.
Copper, long tons	157,621	86,447	Exp. 71,174
Copper, 1909....	188,502	83,667	Exp. 104,835
Tin, long tons....	347	27,853	Imp. 27,506
Tin, 1909.....	265	25,037	Imp. 24,772
Lead, short tons.	31,270	60,715	Imp. 29,445
Lead, 1909.....	59,100	68,619	Imp. 9,519
Spelter, sh. tons.	552	2,293	Imp. 1,741
Spelter, 1909....	2,219	3,053	Imp. 834
Nickel, lb.....	8,172,857	18,924,567	Imp.10,751,751
Nickel, 1909....	6,942,984	11,953,841	Imp. 5,010,857
Antimony, lb....	2,175	6,112,458	Imp. 6,110,283
Antimony, 1909.	6,648	6,272,943	Imp. 6,266,295
Platinum, oz.....	... .	62,502	Imp. 62,502
Platinum, 1909.	... .	62,554	Imp. 62,554
Aluminum, value	$424,766	.....	Exp. $474,766
Aluminum, 1909	218,361	.....	Exp. 218,361
Ores, etc.:			
Zinc oxide, lb.	15,227,493	.....	Exp.15,227,493
Zinc oxide, '09..	17,122,097	.....	Exp.17,122,097
Zinc dross, lb....	6,162,714	.....	Exp. 6,162,714
Zinc dross, '09..	11,782,224	.....	Exp.11,782,224
Zinc ores, lg.tons	12,506	37,484	Imp. 24,978
Zinc ores, 1909.	8,094	67,875	Imp. 59,781
Antim'y ores, lb.	.....	.....	.....
Ant. ores, 1909.	504	3,386,798	Imp. 3,386,294
Chrome ore, tons	30	23,432	Imp. 23,402
Chrome ore, '09	.....	19,676	Imp. 19,676

Copper, lead and nickel (and antimony from Aug. 5, 1909) include the metal contents of ores, matte, bullion, etc. The exports given include reëxports of

foreign material. Zinc contents of ore imported in 1909 were 28,951,433 lb.; not reported prior to date of new tariff. Quantity of antimony ore is not reported this year, only metal contents being given. Imports of aluminum are not reported.

Zinc and Lead Ore Markets

Platteville, Wis., Sept. 3—The highest price paid this week for zinc ore was $43 per ton; the base price, 60 per cent. zinc, was $41@$41.50 per ton. The base price paid for 80 per cent. lead ore was $51@52 per ton.

SHIPMENTS, WEEK ENDED SEPT. 3.

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Galena	661,270	.....	.....
Mineral Point	640,090	.....	.....
Platteville	514,420	.....	316,800
Benton	232,020	.....	48,620
Cuba City	167,020	64,600	276,400
Highland	129,100	.....	.....
Montfort	.....	80,000	.....
Total	2,343,585	144,600	641,820
Year to date	62,140,961	6,304,889	16,701,303

In addition to the above there was shipped during the week to the separating plants, 2,757,345 lb. zinc concentrates.

Joplin, Mo., Sept. 3—The highest price paid for zinc sulphide ore was $46 per ton, on a base price of $43 per ton of 60 per cent. zinc. The highest base price was $43.50 for ores carrying 4 to 5 per cent. iron and only a few bins were sold at that figure. Zinc silicate sold on a base of $20@24 per ton of 40 per cent. zinc. The average price, all grades of zinc, was $38.32 per ton. Lead opened the week firm at $54 and closed with $56 paid for several bins, and the buyers active at the close of business on Saturday night. The average price, all grades of lead, was $53.88 per ton.

SHIPMENTS, WEEK ENDED SEPT. 3.

	Zinc, lb.	Lead lb.	Value.
Webb City-Carterville	4,048,180	783,420	$102,115
Joplin	1,626,550	206,390	38,915
Alba-Neck	1,237,890	9,580	27,472
Duenweg	944,410	67,460	18,585
Galena	697 850	58,360	15,532
Granby	613,510	.....	9,195
Miami	572,460	63,250	8,862
Oronogo	313,390	.....	6,683
Spurgeon	343,060	46,640	6,414
Sarcoxie	256,410	.....	5,251
Aurora	314,120	.....	4,742
Badger	139,730	.....	2,794
Quapaw	168,790	.....	2,530
Carthage	82,560	.....	1,733
Carl Junction	58,180	.....	1,221
Totals	11,417,090	1,235,100	$252,044
36 weeks	398,666,080	58,124,940	$9,303,866

Zinc value, the week, $218,768; 36 weeks, $7,814,025
Lead value, the week, 33,276; 36 weeks, 1,489,841

MONTHLY AVERAGE PRICES.

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$41.25	$47.31	$38.46	$45.16	$52.17	$56.99
February	36.94	40.69	34.37	39.47	50.50	53.64
March	37.40	43.60	34.71	39.71	50.82	51.26
April	38.63	41.00	37.01	39.33	55.63	49.72
May	40.06	40.19	37.42	37.51	56.59	48.16
June	44.15	40.20	40.35	37.83	57.52	48.80
July	43.06	39.63	41.11	36.80	53.74	48.59
August	48.25	40.13	44.54	37.32	57.60	49.75
September	47.70	.....	44.87	.....	56.11	.....
October	49.50	.....	45.75	.....	55.02	.....
November	51.31	.....	48.29	.....	53.94	.....
December	49.45	.....	47.57	.....	55.26	.....
Year	$43.98	.....	$41.20	.....	$54.60	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

CHEMICALS

New York, Sept. 7—The general markets are improving a little and more inquiries are being received.

The General Chemical Company, of California, a new company with $1,250,000 preferred and $1,500,000 common stock, controlled by the General Chemical Company, has bought the important works of the Peyton Chemical Company, and the adjoining new works at Bay Point, near San Francisco. The Peyton works are by far the most important on the Pacific Coast.

Copper Sulphate—On a moderate trade prices are unchanged, at $4 per 100 lb. for carload lots and $4.25 per 100 lb. for smaller orders.

Arsenic—More inquiries are noted for future deliveries, but business is on a small scale. Quotations are $2.25 per 100 lb. for white arsenic.

Nitrate of Soda—The market for this article has improved a little. Spot is quoted at 2.10@2.12½c. per lb., while 2.12½@2.15c. per lb. is asked for futures.

Messrs Mortimer & Wisner, New York, report the position of nitrate in the United States on Sept. 1 as follows, in long tons:

	1909.	1910.	Changes.
Stocks, Jan. 1	9,140	14,000	I. 4,860
Imports, 8 mos.	211,700	315,200	I. 103,500
Total supplies	220,840	329,200	I. 108,360
Deliveries, 8 mos.	208,040	316,500	I. 108,460
Stocks, Sept. 1	12,800	12,700	I. 100
Afloat for U. S.	70,000	60,000	D. 10,000

Quantities afloat include all cargoes due to arrive at U. S. ports before Dec. 15 next.

Petroleum

Exports of mineral oils from the United States, seven months ended July 31, in gallons:

	1909.	1910.
Crude petroleum	70,135,170	64,171,176
Naphthas	42,622,960	47,337,579
Illuminating oil	595,991,394	536,162,245
Lubricating and paraffin	81,429,108	90,703,077
Residuum	59,974,256	61,191,487
Total	850,152,888	799,565,564

The total decrease this year was 50,587,324 gal., or 6 per cent.

MINING STOCKS

New York, Sept. 7—A double holiday this week helped to make the market even more dull than it has been, the Stock Exchange adjourning from Friday over to Tuesday. Business has been extremely slow, some brokers going so far as to say there was no market.

The Curb was much the same, trading being light in all issues. There was no positive weakness, and prices showed only fractional changes. There was hardly business enough, however, to test the market, and dullness was the prominent point.

Boston, Sept. 6—The copper-share market has lapsed into utter dullness and naturally prices are a shade lower. The contention that copper shares have been pretty thoroughly liquidated still holds good, as shown by the fact that offerings

COPPER PRODUCTION REPORTS.
Copper contents of blister copper, in pounds.

Company.	June.	July.	August.
Arizona, Ltd.	2,802,000	2,910,000	.....
Balakiala	1,226,000	1,100,000	.....
Boleo (Mexico)	2,115,314	2,272,600	.....
Copper Queen	10,219,687	10,730,372	9,426,763
Calumet & Ariz.	2,490,000	2,705,000	.....
Cananea (Mexico)	4,280,000	4,500,000	3,526,000
Detroit	2,017,000	1,800,000	2,100,000
Imperial	800,000	800,000	.....
Nevada Con.	6,186,832	6,896,429	.....
Old Dominion	2,092,000	2,000,000	2,693,000
Shannon	1,528,000	2,207,000	.....
Superior & Pitts.	2,245,000	2,224,000	.....
Utah Copper Co.	8,358,496	8,677,000	.....
Butte District	23,750,000	28,366,380	21,720,100
Lake Superior	18,000,000	19,000,000	.....
Total production	88,130,329	91,188,781	.....
Imports, bars, etc.	20,817,978	17,714,034	.....
Imp. in ore & matte	5,579,618	6,637,836	.....
Total	114,527,915	115,540,651	.....

Butte district and Lake Superior figures are estimated; others are reports received from companies. Imports duplicate production of Cananea, and that part of Copper Queen production which comes from Nacozari. Boleo copper does not come to American refiners. Utah Copper report includes the output of the Boston mill.

STATISTICS OF COPPER.

Month.	United States Product'n.	Deliveries, Domestic.	Deliveries for Export.
IX, 1909.	118,023,139	52,105,955	50,077,777
X	124 657,709	66,359,617	56,261,238
XI	121,618,369	66,857,873	55,266,595
XII	117,828,655	69,519,501	59,546,570
Year	1,405,403,056	705,051,591	680,942,620
I, 1910.	116,547,287	78,158,387	81,691,672
II	112,712,493	66,618,322	37,369,518
III	120,067,467	62,344,818	40,585,767
IV	117,477,639	67,985,951	31 332,434
V	123,242,476	59.305,222	45,495,400
VI	127,219,188	53,363,196	65,895,948
VII	118,370,003	56,708,175	59,407,167
VIII	.....	.....	.....

	Visible Stocks. United States.	Europe.	Total.
IX, 1909.	135 196,930	197,993,600	333,190,530
X	151,472,772	210,224,000	361,696,772
XI	153,509,626	222,566,400	376,076,026
XII	153,003,527	236,857,600	389,861,127
I, 1910.	141,766,111	244,204,800	385,970,911
II	98,463,339	248,236,800	346,700,139
III	107,187,992	254,150,400	361,338,392
IV	123,824,874	249,625,600	373,450,474
V	141,984,159	246,870,400	388,854,559
VI	160,425,973	239,142,400	399,568,373
VII	168,386,017	232,892,800	401,278,817
VIII	170,640,678	222,320,000	392,960,678
IX	.....	218,444,800	.....

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

are at a minimum and sentiment continues optimistic.

It is needless to go into detail regarding price movements. The market is one of specialties. A few of the newer Lake Superior properties have received slight upward movements, but the advances are not sustained, while in many cases prices react as soon as favorable news appears. Developments at the Indiana and Algomah prospects are reported favorable and have caused more or less buoyancy.

Declaration of the regular $7 dividend by the Calumet & Hecla has tended to keep the price up around the recent high levels, while the regular $5 dividend by the Wolverine inspires confidence in the general situation.

Curb trading has been of fair volume, with the bulk of business in Algomah and Chino of the better class of stocks.

Assessments

Company.	Delinq.	Sale.	Amt.
American, Ida	Sept. 22	Oct. 15	$0.002
Bullion, Nev	Aug. 11	Sept. 12	0.05
Challenge, Nev	Sept. 7	Sept. 28	0.10
Ely Con., Nev	.....	Oct. 10	0.05
Exchequer, Nev	Sept. 14	Oct. 4	0.05
Hancock Con., Mich	Au.Oct.	.....	3.00
Hypothek, Ida	Sept. 12	Oct. 8	0.005
Julia, Nev	Aug. 6	Sept. 6	0.03
Little Butte, Ida	Sept. 15	Oct. 13	0.002
Live Oak, Ariz	Oct. 1	.....	3.00
Potosi G. & S. Min, Nev	Sept. 6	Sept. 28	0.10
Raven, Mich	Aug. 15	.....	0.10
Rhode Island, Ida	Sept. 14	Oct. 14	0.001
Savage, Nev	Sept. 21	Oct. 13	0.10
Scorpion, Nev	Aug. 11	Sept. 6	0.02
Scottish Chief, Utah	Aug. 10	Sept. 20	0.01
Seg. Belcher & Midas Con., N.	Sept. 6	Sept. 27	0.05
Tintic Central, Utah	Aug. 10	.....	0.00½
Union, Nev	Sept. 19	Oct. 19	0.10
Utah, Nev	Sept. 6	Sept. 27	0.05
Winona, Mich	Aug. 9	.....	1.00
Yellow Jacket, Nev	Sept. 15	Oct. 20	0.15

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1909.	1910.	1909.	1910.
January	51.750	52.375	23.843	24.154
February	51.472	51.534	23.706	23.794
March	50.468	51.454	23.227	23.690
April	51.428	53.221	23.708	24.483
May	52.905	53.870	24.343	24.797
June	52.538	53.462	24.166	24.651
July	51.043	54.150	23.519	25.034
August	51.125	52.912	23.588	24.428
September	51.440	.....	23.743	.....
October	50 923	.....	23.502	.....
November	50.703	.....	23.351	.....
December	52.226	.....	24.030	.....
Total	51.502	.....	23.706	.....

New York, cents per fine ounce; London, pence per standard ounce.

COPPER.

	New York.				London.	
	Electrolytic		Lake.			
	1909.	1910.	1909.	1910.	1909.	1910.
January	13.893	13.620	14.280	13.870	61.198	60.923
February	12.949	13.332	13.295	13.719	57.688	59.388
March	12.387	13.255	12.826	13.586	56.231	59.214
April	12.56¼	12.733	12.93¾	13.091	57.363	57.238
May	12.893	12.550	13.238	12.885	59.338	56.313
June	13.214	12.404	13.548	12.798	59.627	55.310
July	12.880	12.215	13.363	12.570	58.556	54.194
August	13.007	12.490	13.296	12.715	59.393	55.733
September	12.870	.....	13.210	.....	59.021	.....
October	12.700	.....	13.030	.....	57.551	.....
November	13.125	.....	13.354	.....	58.917	.....
December	13.298	.....	13.647	.....	59.906	.....
Year	12.982	.....	13.335	.....	58.732	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1909.	1910.	Month.	1909.	1910.
January	28.060	32.700	July	29.125	32.695
February	28.290	32.920	August	29.966	33.972
March	28.727	32.403	September	30.293	.....
April	29.445	32.976	October	30.475	.....
May	29.225	33.125	November	30.859	.....
June	29.322	32.769	December	32.913	.....
			Av. Year	29.725	.....

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis.		London.	
	1909	1910.	1909.	1910.	1909.	1910.
January	4.175	4.700	4.025	4.582	13.113	13.650
February	4.018	4.613	3.868	4.445	13.313	13.328
March	3.986	4.459	3.835	4.307	13.438	13.063
April	4.168	4.376	4.051	4.225	13.297	12.641
May	4.287	4.315	4.214	4.164	13.225	12.550
June	4.350	4.343	4.291	4.207	13.031	12.688
July	4.321	4.404	4.188	4.291	12.563	12.531
August	4.363	4.400	4.227	4.290	12.475	12.513
September	4.342	.....	4.215	.....	12.781	.....
October	4.341	.....	4.215	.....	13.175	.....
November	4.370	.....	4.252	.....	13.047	.....
December	4.560	.....	4.459	.....	13.125	.....
Year	4.273	.....	4.153	.....	13.049	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York.		St. Louis.		London.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	5.141	6.101	4.991	5.951	21.425	23.350
February	4.889	5.569	4.739	5.419	21.562	23.188
March	4.757	5.637	4.607	5.487	21.438	23.031
April	4.965	5.439	4.815	5.289	21.531	22.469
May	5.124	5.191	4.974	5.041	21.975	22.100
June	5.402	5.128	5.252	4.978	22.000	22.219
July	5.402	5.152	5.252	5.002	21.969	22.406
August	5.729	5.279	5.579	5.129	22.125	22.800
September	5.796	.....	5.646	.....	22.906	.....
October	6.199	.....	6.043	.....	23.200	.....
November	6.381	.....	6.231	.....	23.188	.....
December	6.249	.....	6.099	.....	23.094	.....
Year	5.503	.....	5.352	.....	22.201	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PRICES OF PIG IRON AT PITTSBURG.

	Bessemer.		Basic.		No. 2 Foundry.	
	1909.	1910.	1909.	1910.	1909.	1910.
January	$17.18	$19.90	$16.40	$17.98	$16.26	$17.94
February	16.73	18.96	16.09	17.21	15.90	17.38
March	16.40	18.53	15.84	16.93	15.62	17.00
April	15.79	18.28	15.05	16.84	15.06	16.75
May	15.77	17.10	15.02	15.94	15.08	16.18
June	16.13	16.52	15.84	15.60	15.63	15.53
July	16.40	16.40	15.90	15.40	15.96	15.40
August	17.16	16.09	16.17	14.89	16.20	15.16
September	18.44	.....	16.80	.....	17.03	.....
October	19.75	.....	17.84	.....	18.02	.....
November	19.90	.....	18.37	.....	18.09	.....
December	19.90	.....	18.15	.....	17.90	.....
Year	$17.46	.....	$16.46	.....	$16.40	.....

STOCK QUOTATIONS

COLO. SPRINGS Sept. 6

Name of Comp.	Bid.
Listed:	
Acacia	.05½
Cripple Cr'k Con.	.02½
C. K. & N.	.16½
Doctor Jack Pot	.07½
Elkton Con	.74½
El Paso	.83
Fannie Rawlins	‡.05½
Findlay	.09
Gold Dollar	‡.14½
Gold Sovereign	.03½
Isabella	.18
leary McKinney	‡.53
Pharmacist	.02½
Portland	1.17
Vindicator	.90
Work	.04
Unlisted:	
Golden Cycle	‡1.00
United Gold Mines	‡.07½

SALT LAKE Sept. 6

Name of Comp.	Clg.
Carisa	.15
Colorado Mining	.30½
Columbus Con	.65
Daly Judge	4.25
Grand Central	1.17½
Iron Blossom	.88
Little Bell	1.10
Little Chief	‡.22
Lower Mammoth	.15
Mason Valley	7.40
Maj. Mines	‡.53
May Day	.05½
Nevada Hills	2.15
New York	‡.13
Prince Con	.54
Red Warrior	‡6.00
Silver King Coal'n	2.00
Sioux Con	.24
Uncle Sam	.15
Victoria	‡1.07½

SAN FRANCISCO. Sept. 6.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Alta	.10
Belcher	.49
Best & Belcher	.49
Caledonia	.27
Challenge Con	.20
Chollar	.19
Confidence	.70
Con. Cal. & Va	1.40
Crown Point	.24
Exchequer	.19
Gould & Curry	.32
Hale & Norcross	.35
Mexican	1.40
Ophir	1.55
Overman	.71
Potosi	.39
Savage	.20
Sierra Nevada	.27
Union Con	.36
Yellow Jacket	.62
MISC. NEVADA	
Belmont	3.90
Daisy	.04
Jim Butler	.27
MacNamara	.27
Midway	.24
North Star	.08
West End Con	.60
Atlanta	.13
Booth	.11
C.O.D. Con	.16
Columbia Mt.	.04
Comb. Frac.	.41
Great Bend	.03
Jumbo Extension	.40
Oro	.07
Red Hill	.03
Sandstorm	.04
Silver Pick	.07
St. Ives	.17
Tramps Con	.04

N. Y. EXCH. Sept. 6

Name of Comp.	Clg.
Amalgamated	68
Am. Agri. Chem.	42¾
Am.Sm.&Ref.,com	66¾
Am. Sm. & Ref., pf.	103⅞
Anaconda	39
Bethlehem Steel	57¼
Col. & Hock. C. & I.	4¾
Federal M. & S.	56
Goldfield Con.	8¼
Great Nor., ore ctf.	54
Homestake	87⅞
Nat'nalLead,com.	50½
National Lead, pf.	104
Nev. Consol.	20⅞
Pittsburg Coal	15½
Republic I&S,com.	29
Republic I & S, pf.	94
SlossSheff'd,com.	56
Sloss Sheffield, pf.	‡103
Tennessee Copper	26
Utah Copper	55⅞
U. S. Steel, com.	67½
U. S. Steel, pf.	115½
Va. Car. Chem.	57⅞

N. Y. CURB Sept. 6

Name of Comp.	Clg.
Barnes King	3/16
Bonanza Creek	‡3
Boston Copper	‡18
Braden Copper	3¾
B. C. Copper	4⅝
Buffalo Mines	2⅛
Butte Coalition	18
Caledonia	¾
Chino	14½
Cobalt Central	8
Cobalt Prov.	‡59
Con. Ariz. Sm.	1⅛
Cumberland Ely	‡9
Davis-Daly	1⅛
Dominion Cop	‡7
Ely Con	.33
El Rayo	3⅞
Florence	2⅛
Gila Copper	‡5
Giroux	6¼
Gold Hill	⅜
Greene Canahea	7
Guanajuato	‡1⅝
Guggen. Exp	180
Kerr Lake	6
La Rose	3⅛
McKinley-Dar-Sa.	1.01
Miami Copper	18¾
Mines Co. of Am.	55⅝
Mont. Shoshone	‡.37½
Mont.-Tonopah	‡.98
Nev. Utah M. & S.	1/16
New Baltic	‡5
Nipissing Mines	10¾
Ohio Copper	1⅛
Pacific Sm. & M.	1/16
Ray Central	2⅜
Ray Con	18⅜
Silver Queen	‡35
Standard Oil	600
Stewart	⅜
Tonopah	8¾
Tonopah Ex.	.90
Tri-Bullion	½
Tuolumne	2.40
Yukon Gold	3⅞

LONDON Sept. 7

Name of Com.	Clg.
Dolores	£1 10s 0d
Stratton'sInd.	0 3 3
Camp Bird	1 11 9
Esperanza	2 13 1½
Tomboy	0 16 3
El Oro	1 6 9
Oroville	‡0 5 9
Mexico Mines	9 4 0

BOSTON EXCH. Sept. 6

Name of Comp.	Clg.
Adventure	‡6
Allouez	‡40
Am. Zinc	25
Arcadian	5
Arizona Com	16
Atlantic	‡5¾
Boston Con	‡18
Butte & Balak	6¼
Calumet & Ariz.	58½
Calumet & Hecla	555
Centennial	‡18
Con. Mercur	‡.10
Copper Range	66
Daly-West	6
East Butte	7
Franklin	11
Granby	‡34
Hancock	20¼
Helvetia	2⅞
Indiana	17¾
Isle Royale	‡19
Keweenaw	‡3¾
Lake	34¾
La Salle	10
Mass	‡7½
Michigan	‡4⅞
Mohawk	48
Nevada	20¼
North Butte	27½
North Lake	9
Ojibway	5½
Old Dominion	‡36
Osceola	125
Parrot	14
Quincy	72¾
Shannon	‡10
Superior	44
Superior & Bost.	‡8½
Superior & Pitts.	‡11⅞
Tamarack	‡57
Trinity	5½
U. S. Smg. & Ref.	38½
U.S.Sm. & Re., pd.	49
Utah Apex	3½
Utah Con	23
Victoria	‡2½
Winona	‡7½
Wolverine	‡125
Wyandotte	‡1¾

BOSTON CURB Sept. 6

Name of Comp.	Clg.
Ahmeek	186
Bingham Mines	3
Boston Ely	1¼
Boswyocolo	.08
Cactus	1¼
Calaveras	10¾
Champion	.05
Chemung	8½
Chief Cons	1½
Cons. Ariz.	17⅛
Corbin	5½
Crown Reserve	2¾
First Nat. Cop	3½
Inspiration	7⅛
Mackinaw	.20
Majestic	.49
Nat'l Mine	‡.11
Nevada-Douglas	1⅛
Oneco	2⅞
Raven Copper	.29
Rhode Island Coal	6¾
San Antonio	‡6
Shattuck-Ariz	21
South Lake	8¾
Superior & Globe	.20
Tretheway	1⅜
Tuolumne Copper	2¼
Vulture	9¼
Yuma	.30

‡Last quotation.